

THE CORRELATION OF ABILITIES OF HIGH SCHOOL PUPILS

BY

DAVID EMRICH WEGLEIN

A DISSERTATION

Submitted to the Board of University Studies of The Johns
Hopkins University in Conformity with the Requirements
for the Degree of Doctor of Philosophy

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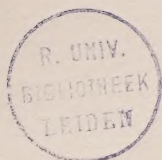
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PREFACE

The subject of this study was suggested several years ago by Professor George D. Strayer, of Columbia University, under whose direction the work was begun. In the preparation of this dissertation, the author received valuable suggestions, for which he expresses grateful acknowledgment to Professor Edward F. Buchner and Professor John B. Watson, of the Johns Hopkins University, and to Professor George D. Strayer, of Columbia University.

D. E. W.

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THE CORRELATION OF ABILITIES OF HIGH SCHOOL PUPILS

In recent years the subject of the correlation of abilities of individuals has been discussed with a great deal of interest. Considerable study has been given to this topic, probably because of its bearing upon the doctrine of formal discipline, over which many a severe battle has been fought. It has been felt that a close study of the correlation of mental abilities of individuals will throw considerable light upon the validity of the contention of those who in recent years have so vigorously attacked the formal discipline doctrine. The subject of the correlation of mental abilities has been given considerable attention, moreover, because of the close connection between it and the very important and practical topic of the grouping of school subjects into courses, adaptation of the elective system to the needs of individual students, etc.

In 1901, Wissler in a monograph upon "The Correlation of Mental and Physical Tests," published in the *Psychological Review*, Monograph Supplements, Vol. III, presented the following results, based upon the study of the records of collegiate students in Columbia University:

Subjects Correlated	No. of Cases Considered	Coef. of Corr.
Latin and mathematics	228	0.58
Mathematics and rhetoric	222	0.51
Latin and rhetoric	223	0.55
French and rhetoric	122	0.30
German and rhetoric	132	0.61
German and mathematics	115	0.52
Latin and French	130	0.60
Latin and German	129	0.61
Latin and Greek	121	0.75
Gymnasium and average grade	119	0.53

As might be expected, on account of the close relationship existing between the two subjects, the coefficient in the case of Latin and Greek is very high, 0.75. In the other cases, the coefficients range (with one exception) from 0.61 to 0.51, all of them rather high. The exceptional case, that of French and rhetoric, having a coefficient of correlation of 0.30, is not explained.

In the *Columbia Contributions to Philosophy, Psychology, and Education*, Vol. XI, No. 2, published in 1903, the subject is treated under the title of "Heredity, Correlation and Sex Differences in School Abilities," under the editorial supervision of Edward L. Thorndike. The first paper in this series gives the results of a study made by A. G. Smith of the records of 1,529 elementary school pupils from the fourth to the eighth grade. The coefficients found were as follows:

Subjects Correlated	Coef. for Boys	Coef. for Girls	Average
English and mathematics.....	.36	.43	.395
English and geography.....	.49	.38	.435
English and drawing.....	.27	.14	.155
Mathematics and geography.....	.42	.30	.36
Mathematics and drawing.....	.16	.12	.14
Geography and drawing.....	.14	.11	.125

Smith gives, also, the figures derived from the examination records of four fourth grade classes (two of boys and two of girls) in the subjects of arithmetic and geography. The coefficients obtained were as follows:

	Coef. (Obtained by One Method of Calculation)	Coef. (Obtained by Another Method of Calculation)
Grade A (boys)	.26	.23
Grade B (boys)	.43	.43
Grades A and B, together	.34	.33
Grade C (girls)	.28	.28
Grade D (girls)	.45	.57
Grades C and D, together	.37	.43
General average for boys and girls .	.355	.38

The author shows that the average of these last two coefficients (.355 and .38) is almost the same as the coefficient obtained from the study of the term records (.36).

In the same volume, a paper by W. P. Burris, entitled, "The Correlations of the Abilities Involved in Secondary School Work," presents the results of a study of the marks made by secondary school pupils in sixteen different high schools in the states of New York, Pennsylvania, Minnesota, and California. In nine of these schools, the records were kept in as many different systems of arbitrary symbols. This fact has a bearing upon the results obtained from a consideration of all the data considered. The coefficients arrived at were as follows:

	Eng.	Latin	Math.	Hist.	Geom.	Science
Latin.....	.48					
Mathematics.....	.39	.40				
History.....	.40	.43	.33			
Science.....	.41	.44	.41	.40		
Algebra.....					.45	
General average.....	.54	.57	.53	.49		.57

Another article in the same volume is entitled, "The Relationships between the Abilities Involved in Secondary School Subjects," by Brinckerhoff, Morris and Thorndike. The data included the marks made by 232 boys and girls in from 8 to 30 examinations in the New York Regents Examinations given in 1900. These records were used in order to avoid the variation due to the personal equation of the teacher involved in ordinary school marks. These data are for pupils who came from one school. Difficulty in using this material arose from the fact "that cases of failure in the examinations were not always reported, and cases where a pupil avoided the examinations because of his inability in the field are not reported at all." The Pearson coefficients of correlation were calculated "for the highest fifty per cent in each study with the other studies in those cases where the number of individuals was sufficient to

make this worth while. By thus taking only the upper half, we, to a large extent, eliminate the inaccuracy due to the absence of cases of total failure." The coefficients obtained were the following (the figures in parentheses indicating the number of individuals involved):

	Lat.	Eng.	Math.	Science	Hist.	German
Latin....						
Eng.....	.50(70)					
Math....	.31(66)	.09(104)				
Science..	.35(34)	.26(88)	.07(75)			
Hist.....	.44(57)	.41(100)	.26(108)	.61(55)		
German..	.48(31)	.30(60)	.48(51)	.57(36)	.42(49)	
Draw....	.40(55)	.20(88)	.02(85)	.30(59)	.16(87)	

C. Spearman, in an article entitled, "General Intelligence, Objectively Determined and Measured," published in the American Journal of Psychology, Vol. XV, 1904, reports the following coefficients:

	Classics	French	Eng.	Math.	Music
Classics.....	0.87	0.83	0.78	0.70	0.63
French.....	0.83	0.84	0.67	0.67	0.57
English.....	0.78	0.67	0.89	0.64	0.51
Mathematics.....	0.70	0.67	0.64	0.88	0.51
Music.....	0.63	0.57	0.51	0.51	

Rietz and Shade (in Univ. of Illinois Studies, Vol. III) correlated in 1908 the marks made by first year students in the Univ. of Illinois. They found the coefficient for mathematics and foreign languages to be 0.48, and the one for mathematics and natural science, 0.44.

Frailey and Crain, in an article upon "Correlation of Excellence in Different School Subjects Based on a Study of School Grades," published in the Journal of Educational Psychology in 1914, report the results obtained from a study of the school records made by 32 students, who entered the Urbana High School in the fall of 1908, and were graduated in 1912. These 32 pupils studied algebra, civics, American

history, geometry, Latin, and English under the same instructors. Eighteen of the pupils were boys, and fourteen were girls. The authors state the following conclusions:

"(1) That there is a correlation of excellence in the various subjects of study; (2) that the most perfect correlation exists among the brightest and among the most stupid children; (3) that the least perfect correlation exists among the pupils of medium ability; (4) that it is rare for a pupil to represent both extremes of the excellence distribution."

The authors compared the standing of the 32 pupils in the four successive years of work in English, and noted the following: "(1) That there is a correlation of excellence in successive years of study; (2) that the most perfect correlation exists among the brightest and among the most stupid children; (3) that the least perfect correlation exists in the medium group, representing students of average ability; (4) that never (in the cases studied) does a pupil rank among the brightest students one year and among the most stupid another; . . . (5) that a more perfect correlation exists between excellence in one study during succeeding years than exists between excellence in various studies of different nature."

Charles N. Moore, in an article "On Correlation and Disciplinary Values," published in *School and Society*, Vol. II, No. 37, Sept. 11, 1915, reports the coefficients of correlation between the first and second semester grades in algebra made by 254 boys and 198 girls of the Hughes High School, Cincinnati. He calculated, also, the coefficients of correlation for the grades made in geometry and English by 229 of the above-mentioned boys and 192 of the girls. The results obtained were the following:

Algebra-algebra (boys)	0.71 $\pm$ 0.02
Geometry-English (boys)	0.52 $\pm$ 0.03
Algebra-algebra (girls)	0.65 $\pm$ 0.03
Geometry-English (girls)	0.59 $\pm$ 0.03

THE PURPOSE OF THIS INVESTIGATION

It is evident from a consideration of the work which has already been done in studying the amount of correlation existing between the abilities of high school pupils, as indicated by the grades made in the several subjects, that there exists a need for further study along these lines for large numbers of pupils, and in as many different schools as possible. The subjects of each year should be correlated separately. All school subjects, as far as possible, should be included in the study. Whenever possible, the pupils included should constitute a non-selected group. In schools large enough to have several teachers of any one subject, the results are likely to be more significant because the effect of the personal equation of the teacher is apt to be less influential.

This study deals with the school records of the Western High School, Baltimore. The pupils are girls only, and the enrollment during the time under consideration varied from about 1000 to 1200. The pupils included in the investigation consisted of those entering the first year in September, 1907. It is evident that it is advantageous to deal with a non-selected group, that is, non-selected among those who arrive at the high school stage of the system. These pupils, especially in the lower years, were taught by several teachers in each subject, and consequently the personal equation, which might be a considerable factor in the case of one teacher, is not so likely to invalidate the results obtained. As the pupils were girls only, variation due to sex differences is eliminated.

The number of pupils who entered the first year class was 341. Of these, 86, on account of withdrawal from the school, did not have a complete record for at least one year of work, and are not included at all in this study. Of

the remaining 255 members, who completed at least one year of the course, 113 were graduated in four years, in June, 1911; 8 completed the requirements for graduation in five years, and 132 withdrew between the end of the first year and the end of the fourth year. The graduates, therefore, numbered, in all, 121 members or 35.5 per cent of the total entering group of 341.

This study is divided into two parts. Part I deals with the consideration of the coefficients of correlation existing between the school grades made by the 121 graduates in the four years of their high school course. Part II is a study of the relation between the results obtained in several ability tests and the school grades of some of the pupils who entered the first year class of the school in September, 1915.

In this investigation the relationship between the abilities of a group of pupils, as shown by the school records made by them in two subjects, is expressed by the Pearson coefficient of correlation. This coefficient expresses in a single number the relation between the items belonging to each one of a group of individuals, in the following manner: If the items of each kind are arranged in a series, the value of the coefficient of correlation between the two series would indicate the probability that, in general, would exist for individuals to have a similar rank, above or below the median or average, in the other series. The coefficient of correlation can have any value from $+1$ as a maximum to -1 as a minimum. A coefficient of $+1$ between the two series would indicate that the individual ranking high in the one series would, in general, rank correspondingly high in the other series. On the other hand, a coefficient of -1 would imply that the individual ranking low in one series, would, in general, rank correspondingly high in the other. A coefficient of 0 would show that, in all probability, there is no definite relation between rank in one series and the corresponding rank of the same individual in the other series. A coefficient of $+ .25$ would indicate that individuals holding certain ranks above or below the median or average in

the one series would, in general, occupy ranks of .25 of the former rank above or below the median or average in the second series, provided reduction has been made to the variabilities as units.

The formula used for the calculation of the Pearson coefficient of correlation is as follows:

$$r = \frac{\sum xy}{n\sigma_1\sigma_2}$$

where x and y indicate the deviations from the corresponding medians of the two series, n is the number of individuals under consideration, and σ_1 and σ_2 are the standard deviations for the two series. σ_1 is calculated by the formula

$$\sqrt{\frac{\sum x^2}{n}}, \text{ and } \sigma_2 \text{ by the formula } \sqrt{\frac{\sum y^2}{n}}.$$

FIRST YEAR RECORDS

We shall now enter upon a consideration of the first year records made by the pupils included in this study. Each pupil is required to pursue four major subjects (i. e., subjects occupying four or five periods per week and requiring home preparation). In the first year there are five major subjects offered, viz., English I, algebra I, Latin I, history I, and science I (the Roman numeral indicates the year of the subject). The first two subjects, English I and algebra I, are required of all pupils. Consequently, each pupil must select two of the three remaining subjects. Three combinations are thus possible: Latin I and history I, Latin I and science I, history I and science I. In addition to the major subjects mentioned, each pupil is required to take drawing I and music I. These subjects require no home preparation, and are given only one-half as much credit per period as is given to the major subjects. Individual marks are not given in music, and for this reason the subject is not included in this investigation. The mark for a pupil in any subject is the average of the two semester marks. The latter are based upon the results of tests and the usual class recitations. The maximum mark is 100, and a grade of 60 is required for passing.

If we consider the records made in the first year subjects English I and algebra I by the 121 graduates, we find the following distribution:¹

¹ This table is included only to show the distribution of the records made in each of the two subjects. The same is true of similar tables which appear later. In the appendix there are given tables showing the correlation existing between records made in the subjects of the first year course.

	English I No. of Pupils (121)	Algebra I No. of Pupils (121)
95-99	0	5
90-94	2	18
85-89	10	18
80-84	28	24
75-79	30	23
70-74	26	13
65-69	20	10
60-64	4	6
55-59	1	4
Median	76	81
St. dev.	6.9	10.0

It should be noted that the median is higher in algebra I than in English I, and that the variability is greater.

$$r = \frac{\Sigma xy}{n\sigma_1\sigma_2} = \frac{+2508}{(121)(6.9)(10.0)} = +.30$$

$$\text{P.E.} = .06$$

Burris (in 1903) found the coefficient of correlation for English and mathematics was .39. It should be remembered that his result was calculated not upon the first year records only, but, in all probability, upon records in all years of the high school. Moreover, different systems of grading were used in the different schools included in the study. In the study of the Regents Examinations marks by Brinckerhoff, Morris and Thorndike (1903) the coefficient for English and mathematics was .09, but this included geometry as well as algebra, and more years of English than merely the first. Spearman (1904) found the coefficient of correlation between English and mathematics to be 0.64.

As English I and algebra I were the only two compulsory major subjects in the first year, not all of the 121 graduates pursued any one of the other three major subjects. Considering the 87 pupils who chose Latin I, we have the following table:

	Latin I	English I	Algebra I
	No. of Pupils (87)	No. of Pupils (87)	No. of Pupils (87)
95-99.....	5	0	4
90-94.....	13	0	17
85-89.....	10	7	12
80-84.....	18	22	17
75-79.....	15	25	18
70-74.....	11	16	7
65-69.....	7	15	5
60-64.....	3	2	5
55-59.....	2	0	2
50-54.....	0	0	0
Below 50.....	3	0	0
Median.....	81	77	81
St. dev.....	11.9	6.4	9.8

It is generally thought that the pupils who select Latin I are somewhat better in ability than those who do not. Comparing the English I records of these 87 pupils with those made by the total number of 121, we find a median of 77 as against one of 76, and a standard deviation of 6.4 as against that of 6.9. Similarly for algebra I. The median in the two cases is the same, 81, and the standard deviation is 9.8 instead of 10.0. The difference in the two cases is slight.

$$r \text{ (for Latin I and English I)} = \frac{+2802}{(87)(11.9)(6.4)} = +.42$$

$$\text{P. E.} = .06$$

Burris found the coefficient for English and Latin to be .48, and Brinckerhoff, Morris and Thorndike obtained a result of .50.

$$r \text{ (for Latin I and algebra I)} = \frac{+3898}{(87)(11.9)(9.8)} = +.38$$

$$\text{P. E.} = .06$$

Burris' coefficient for Latin and mathematics was .40. Brinckerhoff, Morris and Thorndike obtained a coefficient of .31.

The data for 92 pupils who studied history I and English I are:

	History I No. Pupils (92)	English I No. of Pupils (92)
95-99	4	0
90-94	15	2
85-89	16	8
80-84	19	20
75-79	11	23
70-74	15	20
65-69	6	16
60-64	4	2
55-59	2	1
Median	82	76
St. dev.	9.7	6.9

$$r = \frac{+4162}{(92)(9.7)(6.9)} = +.68$$

$$P. E. = .04$$

The corresponding coefficient found by Burriss was .40, and that by Brinckerhoff, Morris and Thorndike was .41.

The distribution for the 61 pupils who studied science I (botany and physical geography), English I, algebra I, and drawing I is:

	Science I No. of Pupils (61)	English I No. of Pupils (61)	Algebra I No. of Pupils (61)	Drawing I No. of Pupils (61)
95-99.....	1	0	2	0
90-94.....	5	2	5	2
85-89.....	10	5	12	16
80-84.....	10	14	9	18
75-79.....	11	11	10	15
70-74.....	13	15	11	7
65-69.....	7	9	8	3
60-64.....	1	4	1	0
55-59.....	2	1	3	0
50-54.....	1	0	0	0
Median.....	78	75	79	81
St. dev.....	9.3	7.5	9.9	5.7

$$r \text{ (for science I and English I)} = \frac{+2663}{(61)(9.3)(7.5)} = +.63$$

$$P. E. = .05$$

$$r \text{ (for science I and algebra I)} = \frac{+1913}{(61)(9.3)(9.9)} = +.34$$

$$\text{P. E.} = .08$$

The corresponding figures of Burris were .41 and .41, respectively, and those of Brinckerhoff, Morris and Thorn-dike were .26 and .07, respectively. In both of these cases, it is probable that sciences other than botany and physical geography were included, and the mathematics included more than algebra I.

$$r \text{ (for science I and drawing I)} = \frac{+1995}{(61)(9.3)(5.7)} = +.62$$

$$\text{P. E.} = .05$$

The data for the other first year combinations are as follows:

	Drawing I	English I	Algebra I
	No. of Pupils (121)	No. of Pupils (121)	No. of Pupils (121)
95-99.....	0	0	5
90-94.....	3	2	18
85-89.....	23	10	18
80-84.....	40	28	24
75-79.....	31	30	23
70-74.....	17	26	13
65-69.....	6	20	10
60-64.....	0	4	6
55-59.....	1	1	4
Median.....	80	76	81
St. dev.....	6.0	6.9	10.0

$$r \text{ (for drawing I and English I)} = \frac{+1836}{(121)(6.0)(6.9)} = +.37$$

$$\text{P. E.} = .05$$

$$r \text{ (for drawing I and algebra I)} = \frac{+1573}{(121)(6.0)(10.0)} = +.22$$

$$\text{P. E.} = .06$$

	Algebra I	History I	Drawing I
	No. of Pupils (93)	No. of Pupils (93)	No. of Pupils (93)
95-99	4	4	0
90-94	14	15	2
85-89	14	16	16
80-84	22	19	32
75-79	16	11	24
70-74	6	15	14
65-69	8	6	4
60-64	6	4	0
55-59	3	2	1
50-54	0	0	0
Below 50	0	1	0
Median	82	81	80
St. dev.	10.4	10.1	6.0

$$r \text{ (for algebra I and history I)} = \frac{+3634}{(93)(10.4)(10.1)} = +.37$$

$$P. E. = .06$$

The coefficient found by Burris for history and mathematics was .33, and that by Brinckerhoff, Morris and Thorndike was 0.26.

$$r \text{ (for history I and drawing I)} = \frac{+2533}{(93)(6.0)(10.1)} = +.45$$

$$P. E. = .06$$

	Latin I No. of Pupils (60)	History I No. of Pupils (60)
95-99	4	2
90-94	11	9
85-89	7	11
80-84	11	14
75-79	9	7
70-74	9	9
65-69	4	3
60-64	2	3
55-59	0	1
50-54	0	0
Below 50	3	1
Median	81	82
St. dev.	12.5	9.8

$$r = +.67$$

$$P. E. = .05$$

The corresponding figure of Burris was .43, and that of Brinckerhoff, Morris and Thorndike was .44.

	Latin I No. of Pupils (27)	Science I No. of Pupils (27)
95-99	1	0
90-94	2	1
85-89	3	5
80-84	6	5
75-79	6	6
70-74	4	6
65-69	2	3
60-64	1	0
55-59	2	1
Median	77	79
St. dev.	9.8	7.8

$$r = +.37$$

$$P. E. = .11$$

The corresponding figure of Burris = .44.

The corresponding figure of B., M., and T. = .35.

	Latin I No. of Pupils (88)	Drawing I No. of Pupils (88)
95-99	5	0
90-94	13	2
85-89	10	14
80-84	17	30
75-79	15	23
70-74	13	13
65-69	6	5
60-64	3	0
55-59	2	1
50-54	1	0
Below 50	2	0
Median	80	80
St. dev.	12.0	6.2

$$r = \frac{+2240}{(88)(12.0)(6.2)} = +.34$$

$$P. E. = .06$$

	History I No. of Pupils (33)	Science I No. of Pupils (33)
95-99	2	1
90-94	6	4
85-89	5	6
80-84	5	4
75-79	4	4
70-74	6	7
65-69	3	4
60-64	1	1
55-59	1	1
50-54	0	1
Median	80	78
St. dev.	10.1	10.6

$$r = \frac{+2938}{(33)(10.1)(10.6)} = +.83$$

$$P. E. = .04$$

The corresponding result for Burris was .40.

The corresponding result for B., M., and T. was .61.

The coefficients of correlation between the general average in all first year subjects made by the 121 graduates and the records made by them in the two required major subjects, were calculated from the following data:

	General Average	English I	Algebra I
	No. of Pupils (121)	No. of Pupils (121)	No. of Pupils (121)
95-99	0	0	5
90-94	8	2	18
85-89	17	10	18
80-84	26	28	24
75-79	25	30	23
70-74	28	26	13
65-69	12	20	10
60-64	5	4	6
55-59	0	1	4
Median	79	76	81
St. dev.	7.7	6.9	10.0

$$r \text{ (for general average and English I)} = \frac{+4622}{(121)(7.7)(6.9)} = +.72$$

$$P. E. = .03$$

$$r \text{ (for general average and algebra I)} = \frac{+6005}{(121)(7.7)(10.0)} = +.64$$

$$P. E. = .04$$

It should be noted that the coefficient of correlation between the general average and English I is greater than that between the general average and algebra I. This indicates that if we desire to take the record made in one subject as an index of the general ability of a pupil, it is better to take the English record as the determining one rather than the mark made in mathematics. This fact is of considerable significance because of its bearing upon the practice of those schools in which promotion is not made upon a subject basis, but upon the record of a pupil in some one subject. In some schools it has been the practice to regard mathematics as the determining subject for promotion, but in the light of the figures obtained in this investigation, the English record would, in all probability, be a better index of the general ability of the pupil.

The summary of the coefficients obtained from the first year records of the 121 graduates is as follows:

FIRST YEAR—121 GRADUATES

	English I	Algebra I	Latin I	History I	Science I	Drawing I	General Average
English I.....	—	.30 (121)	.42 (87)	.68 (92)	.63 (61)	.37 (121)	.72 (121)
Algebra I.....	.30 (121)	—	.38 (87)	.37 (93)	.34 (61)	.22 (121)	.64 (121)
Latin I.....	.42 (87)	.38 (87)	—	.67 (60)	.37 (27)	.34 (88)	
History I.....	.68 (92)	.37 (93)	.67 (60)	—	.83 (33)	.45 (93)	
Science I.....	.63 (61)	.34 (61)	.37 (27)	.83 (33)	—	.62 (61)	
Drawing I....	.37 (121)	.22 (121)	.34 (88)	.45 (93)	.62 (61)	—	

Note.—The figures in parentheses indicate the number of pupils in each case.

An inspection of this table will show that the fifteen coefficients (excluding those involving the general average) are distributed as follows:

One between .8 and .9	.....	{ History I and science I	.....	.83
Four between .6 and .7	.....	{ English I and history I	.....	.68
		{ English I and science I	.....	.63
		{ Latin I and history I	.....	.67
		{ Science I and drawing I	.....	.62
Two between .4 and .5	.....	{ English I and Latin I	.....	.42
		{ History I and drawing I	.....	.45
Seven between .3 and .4	.....	{ English I and algebra I	.....	.30
		{ English I and drawing I	.....	.37
		{ Algebra I and Latin I	.....	.38
		{ Algebra I and history I	.....	.37
		{ Algebra I and science I	.....	.34
		{ Latin I and science I	.....	.37
One between .2 and .3	.....	{ Latin I and drawing I	.....	.34
		{ Algebra I and drawing I	.....	.22

The median coefficient is .38 (algebra I and Latin I). The several subjects when arranged in the order (descending) in which they correlate with the other first year subjects are as follows: History I, science I, English I, Latin I, drawing I, algebra I.

For purposes of comparison with the results obtained above, a study was made of some of the first year records made by all of the 255 pupils who completed at least one year of the school course. This number included the 121 graduates already discussed, and 134 others who withdrew after the end of the first year and before graduation.

	English I No. of Pupils (255)	Algebra I No. of Pupils (255)
95-99	0	6
90-94	4	22
85-89	13	27
80-84	37	36
75-79	44	39
70-74	53	27
65-69	38	36
60-64	27	21
55-59	17	14
50-54	11	5
Below 50	11	22
Median	72	75
St. dev.	10.8	15.3

$$r = \frac{+22617}{(255)(10.8)(15.3)} = +.54$$

$$\text{P. E.} = .03$$

Comparing these results with those obtained for the 121 graduates (page 10), we find the median for English is 72 instead of 76, and the standard deviation, 10.8 instead of 6.9. For algebra I the median is 75 instead of 81, and the standard deviation 15.3 instead of 10.0. These figures for the medians are not unexpected, as the graduates constitute a selected group, i. e., they have been able to complete the school course, and as a group would naturally have a greater ability than the entire number of 255, which included many who withdrew before graduation. The greater variability, moreover, as shown by the figures, bears out our expectations for a similar reason. The coefficient of correlation for the 255 pupils is .54 as compared with .30 for the 121 graduates. The increase in the size of the coefficient is due, in part at least, to the pupils who made very low marks in both subjects, and who subsequently withdrew from the school. On the whole, it seems better to regard the coefficient .30 as more reliable than the larger one.

	Latin I	English I	Algebra I
	No. of Pupils (177)	No. of Pupils (177)	No. of Pupils (177)
95-99.....	6	0	5
90-94.....	19	2	20
85-89.....	13	10	16
80-84.....	24	27	27
75-79.....	26	34	29
70-74.....	21	30	18
65-69.....	18	25	20
60-64.....	11	20	16
55-59.....	13	13	7
50-54.....	10	9	3
Below 50.....	16	7	16
Median.....	74	72	76
St. dev.....	16.1	10.8	15.5

$$r \text{ (for Latin I and English I)} = \frac{+20979}{(177)(16.1)(10.8)} = +.68$$

$$P. E. = .03$$

$$r \text{ (for Latin I and algebra I)} = \frac{+30270}{(177)(16.1)(15.5)} = +.69$$

$$P. E. = .03$$

Comparing these data with those for the 121 graduates, we find medians of 74, 72, 76 instead of 81, 77, 81, respectively, a considerable decrease in each case. The standard deviations 16.1, 10.8, 15.5, instead of 11.9, 6.4, 9.8, show the presence among the 255 pupils of a much greater variability in ability than that found among the 121 graduates. The larger coefficients, .68 and .69, as compared with .42 and .38 in the former case, can be explained in the same way as that for English I and algebra I, and should not be considered as reliable as those obtained for the 121 graduates.

	Latin I No. of Pupils (106)	History I No. of Pupils (106)
95-99	5	3
90-94	16	11
85-89	9	17
80-84	16	17
75-79	13	9
70-74	12	16
65-69	12	9
60-64	5	4
55-59	4	4
50-54	4	3
Below 50	10	13
Median	76	76
St. dev.	16.9	16.3

$$r = \frac{+21898}{(106)(16.9)(16.3)} = +.75$$

$$P. E. = .03$$

The medians for these two subjects are 76 and 76, while the corresponding ones for the 121 graduates were higher, 81 and 82, respectively. The standard variation is 16.9 and 16.3, while the same item for the 121 graduates was 12.5 and 9.8, respectively. The coefficient of correlation is .75, as compared with .67. All of these results agree with those secured in the case of the preceding subjects.

	Latin I No. of Pupils (71)	Science I No. of Pupils (71)
95-99	1	1
90-94	4	1
85-89	3	6
80-84	8	8
75-79	13	12
70-74	9	14
65-69	7	13
60-64	6	6
55-59	8	8
50-54	6	2
Below 50	6	0
Median	71	72
St. dev.	14.3	9.6

$$r = \frac{+6441}{(71)(14.3)(9.6)} = +.66$$

$$P. E. = .05$$

Here the medians for Latin I and science I are 71 and 72 instead of 77 and 79, respectively, for the 121 graduates. The standard deviations are 14.3 and 9.6, as compared with 9.8 and 7.8, respectively. The coefficient of correlation is .66 instead of .37.

	History I No. of Pupils (76)	Science I No. of Pupils (76)
95-99	2	2
90-94	7	4
85-89	6	8
80-84	9	10
75-79	10	8
70-74	12	11
65-69	12	9
60-64	3	10
55-59	3	5
50-54	5	4
Below 50	7	5
Median	73	73
St. dev.	15.3	13.4

$$r = \frac{+13739}{(76)(15.3)(13.4)} = +.88$$

$$P. E. = .02$$

The medians for history I and science I are 73 and 73, while the corresponding ones for the 121 graduates were 80 and 78, respectively. The standard deviations are 15.3

and 13.4 instead of 10.1 and 10.6. The coefficient of correlation is .88 instead of .83.

	History I No. of Pupils (183)	English I No. of Pupils (183)
95-99	5	0
90-94	18	5
85-89	23	10
80-84	26	27
75-79	19	34
70-74	28	42
65-69	21	28
60-64	7	16
55-59	7	11
50-54	8	4
Below 50	21	6
Median	74	73
St. dev.	15.9	10.6

$$r = \frac{+22699}{(183)(15.9)(10.6)} = +.74$$

P. E. = .02

The medians are 74 and 73 instead of 82 and 76, respectively, in the former case. The standard deviations are 15.9 and 10.6, as compared with 9.7 and 6.9, respectively. The coefficient of correlation is .74 instead of .68.

In general, then, if we compare the first year records made by the 255 pupils who finished one year of the course, with the first year records made by the 121 graduates, we can state:

1. That the medians of the former are less;
2. That the standard deviations of the former are greater;
3. That the coefficients of correlation of the former are greater.

These conclusions can be explained by the fact that among the 255 pupils are some with very low marks in all subjects. These pupils, perhaps, had neglected their work toward the end of the year because they did not expect to continue the subject, or because they had the intention of withdrawing at the close of the year. The results in the case of the 121 graduates are, therefore, to be considered more reliable.

SECOND YEAR RECORDS

In the second year, the pupils divide into two groups according to their choice of subjects. These groups may be called "academic" and "commercial." For the academic pupils, English II and geometry I are required of all. Since each pupil must pursue four major subjects, and two of these are compulsory, it follows that only two major subjects are elective, and these are to be chosen from Latin II, German I, French I, history II, and zoology. On account of the small number of pupils electing zoology, no class was formed in that subject. Drawing II and music II, not major subjects, are also required of all. As individual marks are not given in music, it is not included in this investigation. For the pupils who choose the commercial course, there are no electives in the second year. The required major subjects are English II, bookkeeping I, German I, commercial arithmetic (a half-major), and commercial geography (a half-major). Drawing II and music II are also compulsory. We shall now proceed to consider the second year records in a manner similar to that pursued in the case of the first year subjects.

	English II No. of Pupils (88)	Geometry I No. of Pupils (88)
95-99	0	3
90-94	1	10
85-89	8	11
80-84	16	8
75-79	18	13
70-74	22	8
65-69	17	18
60-64	3	10
55-59	1	2
50-54	2	1
Below 50	0	4
Median	74	75
St. dev.	7.9	14.8

$$r = \frac{+3702}{(88)(7.9)(14.8)} = +.36$$

$$\text{P. E.} = .06$$

C. N. Moore found the corresponding coefficient for geometry and English for boys to be $+0.52 \pm 0.03$, and for girls, $+0.59 \pm 0.03$. Our results show a considerably smaller coefficient. Our coefficient for English II and geometry I (.36) in the second year is somewhat larger than the one for English I and algebra I (.30) in the first year.

	English II No. of Pupils (79)	Latin II No. of Pupils (79)
95-99	0	1
90-94	0	1
85-89	7	8
80-84	15	15
75-79	17	9
70-74	17	10
65-69	16	16
60-64	3	12
55-59	2	2
50-54	2	3
Below 50	0	2
Median	74	72
St. dev.	8.1	10.5

$$r = \frac{+3511}{(79)(8.1)(10.5)} = +.52$$

$$P. E. = .05$$

The corresponding result for the first year (English I and Latin I) was smaller, .42.

	English II No. of Pupils (64)	German I No. of Pupils (64)
95-99	0	1
90-94	1	3
85-89	2	15
80-84	9	15
75-79	17	8
70-74	17	8
65-69	15	2
60-64	2	7
55-59	1	3
50-54	0	0
Below 50	0	2
Median	74	80
St. dev.	6.7	11.4

$$r \text{ (for English II and German I)} = \frac{+1681}{(64)(6.7)(11.4)} = +.34$$

$$P. E. = .07$$

	English II No. of Pupils (36)	French I No. of Pupils (36)
95-99	0	1
90-94	1	2
85-89	7	13
80-84	5	8
75-79	4	5
70-74	9	2
65-69	7	4
60-64	2	1
55-59	1	0
50-54	0	0
Below 50	0	0
Median	74	84
St. dev.	8.7	8.3

$$r \text{ (for English II and French I)} = \frac{+892}{(36)(8.7)(8.3)} = +.34$$

$$P. E. = .10$$

It should be noted that the coefficient of correlation for English II and German I is exactly the same as that for English II and French I.

	English II No. of Pupils (14)	History II No. of Pupils (14)
95-99	0	0
90-94	0	2
85-89	1	4
80-84	5	6
75-79	1	2
70-74	6	0
65-69	1	0
Median	76	84
St. dev.	5.3	5.0

$$r = \frac{+209}{(14)(5.3)(5.0)} = +.56$$

$$P. E. = .12$$

The corresponding figure for the first year (English I and history I) was .68. The second year result is not significant on account of the small number of pupils involved.

	English II	Bookkeeping I ₁	Com. Arith.	Com. Geog.
	No. of Pupils (27)	No. of Pupils (27)	No. of Pupils (27)	No. of Pupils (27)
95-99.....	0	0	0	2
90-94.....	2	4	2	2
85-89.....	2	6	0	4
80-84.....	2	5	2	6
75-79.....	5	3	8	4
70-74.....	6	3	5	6
65-69.....	8	3	4	3
60-64.....	2	2	4	0
55-59.....	0	0	1	0
50-54.....	0	1	1	0
Median.....	74	80	72	80
St. dev.....	7.9	10.4	9.5	8.6

$$r \text{ (for English II and bookkeeping I)} = \frac{+387}{(27)(7.9)(10.4)} = +.17$$

$$\text{P. E.} = .12$$

$$r \text{ (for English II and commercial arithmetic)} = \frac{+1299}{(27)(7.9)(9.5)} = +.64$$

$$\text{P. E.} = .07$$

$$r \text{ (for English II and commercial geography)} = \frac{+1230}{(27)(7.9)(8.6)} = +.67$$

$$\text{P. E.} = .07$$

Note the unusually small coefficient for English II and bookkeeping I (.17). The content of the subject of bookkeeping is considerably different from that of the academic subjects.

	English II No. of Pupils (115)	Drawing II No. of Pupils (115)
95-99	0	1
90-94	3	17
85-89	10	34
80-84	18	30
75-79	23	21
70-74	27	8
65-69	25	2
60-64	5	0
55-59	2	1
50-54	2	1
Median	74	84
St. dev.	8.1	7.2

$$r = \frac{+688}{(115)(8.1)(7.2)} = +.13$$

$$\text{P. E.} = .06$$

This is a very small coefficient. Compare with it the corresponding result in the first year for English I and drawing I, .37.

	Geometry I No. of Pupils (78)	Latin II No. of Pupils (78)
95-99	3	1
90-94	9	1
85-89	10	8
80-84	7	15
75-79	11	9
70-74	7	10
65-69	17	15
60-64	8	12
55-59	2	2
50-54	1	3
Below 50	3	2
Median	75	73
St. dev.	14.6	10.5

$$r = \frac{+6526}{(78)(14.6)(10.5)} = +.55$$

$$P. E. = .05$$

The coefficient of correlation for algebra I and Latin I in the first year was .38.

	Geometry I No. of Pupils (46)	German I No. of Pupils (46)
95-99	1	1
90-94	5	3
85-89	8	10
80-84	4	11
75-79	3	5
70-74	4	3
65-69	12	2
60-64	7	7
55-59	0	2
50-54	0	0
Below 50	2	2
Median	71	81
St. dev.	14.4	12.8

$$r \text{ (for geometry I and German I)} = \frac{+2689}{(46)(14.4)(12.8)} = +.32$$

$$P. E. = .09$$

	Geometry I No. of Pupils (30)	French I No. of Pupils (30)
95-99	2	1
90-94	3	2
85-89	3	11
80-84	4	8
75-79	9	2
70-74	4	2
65-69	1	3
60-64	1	1
55-59	1	0
50-54	1	0
Below 50	1	0
Median	79	84
St. dev.	13.4	8.1

$$r \text{ (for geometry I and French I)} = \frac{+1873}{(30)(13.4)(8.1)} = +.57$$

$$\text{P. E.} = .08$$

	Geometry I No. of Pupils (13)	History II No. of Pupils (13)
95-99	0	0
90-94	3	2
85-89	1	4
80-84	2	6
75-79	2	1
70-74	0	0
65-69	2	0
60-64	2	0
55-59	0	0
50-54	0	0
Below 50	1	0
Median	79	84
St. dev.	16.9	5.0

$$r = \frac{+415}{(13)(16.9)(5.0)} = +.38$$

$$\text{P. E.} = .16$$

The coefficient for algebra I and history I in the first year was .37. The number of pupils for geometry I and history II is very small, and consequently the coefficient is not of special significance.

	Latin II No. of Pupils (43)	German I No. of Pupils (43)
95-99	0	1
90-94	1	3
85-89	6	10
80-84	8	10
75-79	3	5
70-74	6	3
65-69	10	1
60-64	7	7
55-59	0	2
50-54	1	0
Below 50	1	1
Median	71	81
St. dev.	10.5	12.1

$$r = \frac{+2764}{(43)(10.5)(12.1)} = +.51$$

$$P. E. = .08$$

	Latin II No. of Pupils (25)	French I No. of Pupils (25)
95-99	1	1
90-94	0	1
85-89	2	12
80-84	4	5
75-79	4	2
70-74	4	1
65-69	4	3
60-64	4	0
55-59	0	0
50-54	1	0
Below 50	1	0
Median	73	85
St. dev.	10.5	7.5

$$r = \frac{+922}{(25)(10.5)(7.5)} = +.47$$

$$P. E. = .10$$

	German I	Bookkeeping I	Com. Arith.	Com. Geog.
	No. of Pupils (18)	No. of Pupils (18)	No. of Pupils (18)	No. of Pupils (18)
95-99.....	0	0	0	1
90-94.....	0	4	1	0
85-89.....	5	5	0	4
80-84.....	4	5	2	4
75-79.....	3	1	6	4
70-74.....	4	1	3	2
65-69.....	1	1	3	3
60-64.....	0	1	3	0
55-59.....	1	0	0	0
Median.....	79	84	74	81
St. dev.....	8.0	8.0	8.5	8.4

$$r \text{ (for German I and bookkeeping I)} = \frac{+957}{(18)(8.0)(8.0)} = +.83$$

P. E. = .05

$$r \text{ (for German I and com. arithmetic)} = \frac{+261}{(18)(8.0)(8.5)} = +.21$$

P. E. = .15

$$r \text{ (for German I and com. geography)} = \frac{+705}{(18)(8.0)(8.4)} = +.58$$

P. E. = .11

	Bookkeeping I	Com. Arith.	Com. Geog.
	No. of Pupils (28)	No. of Pupils (28)	No. of Pupils (28)
95-99.....	0	0	2
90-94.....	4	2	2
85-89.....	6	0	4
80-84.....	5	3	6
75-79.....	3	8	4
70-74.....	3	5	6
65-69.....	4	4	4
60-64.....	2	4	0
55-59.....	0	1	0
50-54.....	1	1	0
Median.....	80	73	80
St. dev.....	10.5	9.4	9.0

$$r \text{ (for bookkeeping I and com. arith.)} = \frac{+1148}{(28)(10.5)(9.4)} = +.42$$

P. E. = .10

$$r \text{ (for bookkeeping I and com. geog.)} = \frac{+1169}{(28)(10.5)(9.0)} = +.44$$

P. E. = .10

$$r \text{ (for com. arith. and com. geog.)} = \frac{+1275}{(28)(9.4)(9.0)} = +.54$$

P. E. = .09

	Drawing II No. of Pupils (88)	Geometry I No. of Pupils (88)
95-99	1	3
90-94	14	10
85-89	23	11
80-84	22	9
75-79	18	13
70-74	6	8
65-69	3	18
60-64	0	10
55-59	1	2
50-54	0	1
Below 50	0	3
Median	84	75
St. dev.	6.9	14.0

$$r \text{ (for geometry I and drawing II)} = \frac{+967}{(88)(6.9)(14.0)} = +.11$$

$$P. E. = .07$$

The corresponding coefficient in the first year for algebra I and drawing I was .22.

	Drawing II No. of Pupils (81)	Latin II No. of Pupils (81)
95-99	0	1
90-94	14	1
85-89	22	8
80-84	19	15
75-79	17	9
70-74	5	10
65-69	2	18
60-64	0	12
55-59	1	2
50-54	1	3
Below 50	0	2
Median	84	71
St. dev.	7.6	10.5

$$r \text{ (for Latin II and drawing II)} = \frac{+206}{(81)(7.6)(10.5)} = +.03$$

$$P. E. = .07$$

The corresponding coefficient in the first year for Latin I and drawing I was .34.

ABILITIES OF HIGH SCHOOL PUPILS

	Drawing II No. of Pupils (66)	German I No. of Pupils (66)
95-99	0	1
90-94	10	3
85-89	20	15
80-84	19	15
75-79	11	9
70-74	2	9
65-69	2	3
60-64	1	7
55-59	1	3
50-54	0	0
Below 50	0	1
Median	84	80
St. dev.	7.2	10.6

$$r \text{ (for drawing II and German I)} = \frac{+604}{(66)(7.2)(10.6)} = +.12$$

$$P. E. = .08$$

	Drawing II No. of Pupils (38)	French I No. of Pupils (38)
95-99	1	1
90-94	6	2
85-89	9	13
80-84	7	9
75-79	7	5
70-74	6	2
65-69	1	5
60-64	0	1
55-59	0	0
50-54	1	0
Below 50	0	0
Median	82	83
St. dev.	8.3	8.2

$$r \text{ (for drawing II and French I)} = \frac{-89}{(38)(8.3)(8.2)} = -.03$$

$$P. E. = .11$$

It is significant and worthy of note that the coefficients of correlation between drawing II and the academic subjects are very small, and now, for the first time in this investigation, a negative coefficient appears. It is true that in absolute value it is extremely small, practically zero; nevertheless, it possesses significance.

	Drawing II No. of Pupils (12)	History II No. of Pupils (12)
95-99	1	0
90-94	1	2
85-89	1	3
80-84	4	6
75-79	4	1
70-74	1	0
Median	81	84
St. dev.	6.5	5.0

$$r = \frac{+243}{(12)(6.5)(5.0)} = +.62$$

P. E. = .12

While this coefficient is very large in comparison with the other coefficients for drawing II and academic subjects, yet the small number of pupils for drawing II and history II deprives this coefficient of special significance. The corresponding coefficient in the first year for history I and drawing I was .45.

	Drawing II No. of Pupils (28)	Bookkeeping I No. of Pupils (28)	Com. Arith. No. of Pupils (28)	Com. Geog. No. of Pupils (28)
95-99	0	0	0	2
90-94	3	4	2	2
85-89	10	6	0	4
80-84	9	5	3	6
75-79	3	3	8	4
70-74	2	3	5	6
65-69	0	4	4	4
60-64	1	2	4	0
55-59	0	0	1	0
50-54	0	1	1	0
Median	84	80	73	80
St. dev.	6.6	10.5	9.4	9.0

$$r \text{ (for drawing II and bookkeeping I)} = \frac{+823}{(28)(6.6)(10.5)} = +.42$$

P. E. = .10

$$r \text{ (for drawing II and com. arith.)} = \frac{+373}{(28)(6.6)(9.4)} = +.21$$

P. E. = .12

$$r \text{ (for drawing II and com. geog.)} = \frac{+1008}{(28)(6.6)(9.0)} = +.66$$

P. E. = .07

It is very desirable to calculate the coefficients of correlation for corresponding subjects in the second and first years.

	English I (in First Year) No. of Pupils (116)	English II (in Second Year) No. of Pupils (116)
95-99	0	0
90-94	2	3
85-89	10	10
80-84	28	18
75-79	29	23
70-74	25	28
65-69	19	25
60-64	3	5
55-59	0	2
50-54	0	2
Below 50	0	0
Median	77	74
St. dev.	6.8	8.0

$$r \text{ (for English I and English II)} = \frac{+4683}{(116)(6.8)(8.0)} = +.83$$

$$P. E. = .05$$

	Latin I (in First Year) No. of Pupils (79)	Latin II (in Second Year) No. of Pupils (79)
95-99	5	1
90-94	13	1
85-89	9	8
80-84	17	15
75-79	14	9
70-74	13	10
65-69	5	17
60-64	3	12
55-59	0	2
50-54	0	3
Below 50	0	1
Median	81	72
St. dev.	9.0	10.1

$$r \text{ (for Latin I and Latin II)} = \frac{+4515}{(79)(9.0)(10.1)} = +.63$$

$$P. E. = .05$$

	Geometry I (in Second Year) No. of Pupils (89)	Algebra I (in First Year) No. of Pupils (89)
95-99	3	4
90-94	10	18
85-89	11	14
80-84	9	16
75-79	14	18
70-74	8	9
65-69	18	5
60-64	10	4
55-59	2	1
50-54	1	0
Below 50	3	0
Median	75	82
St. dev.	13.9	9.3

$$r = \frac{+7212}{(89)(13.9)(9.3)} = +.63$$

$$P. E. = .04$$

	Drawing II (in Second Year) No. of Pupils (118)	Drawing I (in First Year) No. of Pupils (118)
95-99	1	0
90-94	18	3
85-89	34	22
80-84	30	39
75-79	21	31
70-74	8	17
65-69	3	6
60-64	1	0
55-59	1	0
50-54	1	0
Median	84	80
St. dev.	7.5	5.5

$$r = \frac{+2682}{(118)(7.5)(5.5)} = +.55$$

$$P. E. = .04$$

The special significance of these last four coefficients lies in the fact that they do not (with the exception of .83 for English II and English I) greatly exceed some of the coefficients arrived at by comparing the records of pupils in two different subjects in the same year. For instance, the coefficient for English II and Latin II is .52, that for English II and geometry I is .36, and that for Latin II and geometry

SECOND YEAR—121 GRADUATES

	Eng. II	Geom. I	Lat. II	Ger. I	Fr. I	Hist. II	Bkg. I	Com. Arith.	Com. Geog.	Draw. II	Alg. I 1st yr.	Eng. I 1st yr.	Draw. I 1st yr.	Latin I 1st yr.
English II	—	.36 (88)	.52 (79)	.34 (64)	.34 (36)	.56 (14)	.17 (27)	.64 (27)	.67 (27)	.13 (115)	.63 (89)	.83 (116)		
Geometry I	.36 (88)	—	.55 (78)	.32 (46)	.57 (30)	.38 (13)	x	x	x	.11 (88)				
Latin II	.52 (79)	.55 (78)	—	.51 (43)	.47 (25)	x	x	x	x	.03 (81)				.63 (79)
German I	.34 (64)	.32 (46)	.51 (43)	—	x	x	.83 (18)	.21 (18)	.58 (18)	.12 (66)				
French I	.34 (36)	.57 (30)	.47 (25)	x	—	x	x	x	x	— .03 (38)				
History II	.56 (14)	.38 (13)	x	x	x	—	x	x	x	.62 (12)				
Bookkeeping I	.17 (27)	x	x	.83 (18)	x	x	—	.42 (28)	.44 (28)	.42 (28)				
Com. Arith.	.64 (27)	x	x	.21 (18)	x	x	.42 (28)	—	.54 (28)	.21 (28)				
Com. Geog.	.67 (27)	x	x	.58 (18)	x	x	.44 (28)	.54 (28)	—	.66 (28)				
Drawing II	.13 (115)	.11 (88)	.03 (81)	.12 (66)	— .03 (38)	.62 (12)	.42 (28)	.21 (28)	.66 (28)	—			.55 (118)	

Note.—The figures in parentheses indicate the number of pupils in each case. Where less than 10 pupils are involved, no coefficient is given.

I is .55. It is true that the subject matter in geometry I and algebra I is quite different, but on the other hand the content of English II and English I is very much the same, and almost a similar resemblance holds good for Latin II and Latin I, and for drawing II and drawing I. The point to be noted is, that if the coefficients for the same subject in two different years range from .55 to .83, then it should be admitted that coefficients for different subjects in the same year, when they range from about .30 or .40 upward, do possess considerable significance. In passing, it should be noted also, that the generally accepted difference between geometry and algebra is made evident by the coefficient of .63, when compared with .83 for English II and English I.

The summary of the results arrived at in the investigation of the second year records is given in the table on page 36.

Probably, the most significant feature of this table is the extreme smallness of the coefficients for drawing when compared, in general, with those for subjects other than drawing. With the exception of the coefficient for drawing II with history II (.62), commercial geography (.66), and bookkeeping I (.42), the other figures for drawing range from $+.21$ down to $-.03$. In the case of history II, only twelve pupils are involved, so that this coefficient has no special importance. For the two commercial subjects (bookkeeping I and commercial geography), only twenty-eight pupils are included, so that the coefficients for these two cases are not so significant as those obtained for English II (115 pupils), geometry I (88 pupils), German I (66 pupils), Latin II (81 pupils). The question now arises, Why do the coefficients for drawing, in general, fall below those of the other subjects? The answer seems to be that the content of this subject differs greatly from the content of the other subjects studied. It is true that there are low coefficients in other places in the table, for example, German I and commercial arithmetic (.21), English II and bookkeeping I (.17). But in these two cases only eighteen and twenty-seven pupils, respectively, are involved. Moreover,

the coefficients for none of these subjects show, in general, the smallness of those for drawing. If we compare the coefficients for drawing II with those obtained for drawing I with other first year subjects in the table on page 22, we find the latter coefficients do not by any means show the same smallness.

THIRD YEAR RECORDS

In the third year, only one major subject, English III, is compulsory for all pupils. The other three major subjects, necessary to make up the requisite number of four for each pupil, may be selected from the following: Latin III, German II, French II, history III, physics, and stenography and typewriting I. Algebra II, which is equivalent to a half-major subject, may be taken in addition to the four required majors. Drawing III and music III are elective. Pupils taking the commercial course have, as majors, English III, bookkeeping II, stenography and typewriting I, and German II. Drawing III and music III are elective for them also.

	English III No. of Pupils (35)	Latin III No. of Pupils (35)
95-99	0	0
90-94	1	8
85-89	5	11
80-84	21	7
75-79	6	3
70-74	2	5
65-69	0	0
60-64	0	1
Median	82	86
St. dev.	3.8	7.8

$$r \text{ (for English III and Latin III)} = \frac{+108}{(35)(3.8)(7.8)} = +.10$$

$$P. E. = .11$$

The coefficient for English II and Latin II we found to be .52, and that for English I and Latin I, .42. The small size of the coefficient for English III and Latin III seems to be irregular.

	English III No. of Pupils (55)	German II No. of Pupils (55)
95-99	0	0
90-94	0	2
85-89	8	10
80-84	19	11
75-79	12	17
70-74	10	8
65-69	2	3
60-64	4	4
Median	75	77
St. dev.	7.3	7.5

$$r \text{ (for English III and German II)} = \frac{+1369}{(55)(7.3)(7.5)} = +.45$$

$$\text{P. E.} = .07$$

The coefficient for English II and German I in the second year was found to be .34.

	English III No. of Pupils (33)	French II No. of Pupils (33)
95-99	0	1
90-94	0	10
85-89	7	7
80-84	10	10
75-79	7	4
70-74	5	0
65-69	2	1
60-64	2	0
Median	80	85
St. dev.	7.2	5.9

$$r = \frac{+507}{(33)(7.2)(5.9)} = +.36$$

$$\text{P. E.} = .10$$

This figure is in close agreement with the one found for English II and French I in the second year, .34.

	English III No. of Pupils (59)	History III No. of Pupils (59)
95-99	0	0
90-94	1	8
85-89	12	14
80-84	22	11
75-79	13	11
70-74	10	5
65-69	1	3
60-64	0	4
55-59	0	2
50-54	0	1
Median	80	82
St. dev.	5.5	10.2

$$r = \frac{+1809}{(59)(5.5)(10.2)} = +.55$$

$$P. E. = .06$$

The corresponding coefficient in the second year (for English II and history II) was exactly the same, .55, and that for the first year (English I and history I) was .68.

	English III No. of Pupils (38)	Physics No. of Pupils (38)
95-99	0	1
90-94	0	5
85-89	5	3
80-84	17	10
75-79	11	7
70-74	5	3
65-69	0	8
60-64	0	0
55-59	0	0
50-54	0	0
Below 50	0	1
Median	82	80
St. dev.	5.0	10.5

$$r = \frac{+1367}{(38)(5.0)(10.5)} = +.69$$

$$P. E. = .06$$

	English III No. of Pupils (21)	Algebra II No. of Pupils (21)
95-99	0	2
90-94	0	1
85-89	1	2
80-84	9	4
75-79	6	3
70-74	5	4
65-69	0	2
60-64	0	0
55-59	0	0
50-54	0	3
Median	78	76
St. dev.	4.5	12.5

$$r = \frac{+587}{(21)(4.5)(12.5)} = +.50$$

$$P. E. = .11$$

The corresponding coefficient in the second year (English II and geometry I), .36, and the one in the first year (English I and algebra I), .30, were both smaller. But in the third year, the number of pupils included is so small, that the coefficient for that year is not so significant.

	English III No. of Pupils (26)	Bookkeeping II No. of Pupils (26)
95-99	0	1
90-94	0	3
85-89	5	0
80-84	0	3
75-79	2	6
70-74	7	5
65-69	5	4
60-64	6	4
55-59	1	0
Median	71	75
St. dev.	8.7	10.0

$$r = \frac{+1743}{(26)(8.7)(10.0)} = +.77$$

$$P. E. = .05$$

This is greatly different from the corresponding coefficient in the second year (English II and bookkeeping I), which was .17.

	English III No. of Pupils (44)	Stenography and Typewriting I. No. of Pupils (44)
95-99	0	0
90-94	0	3
85-89	8	4
80-84	5	1
75-79	6	7
70-74	12	12
65-69	5	11
60-64	6	2
55-59	2	3
50-54	0	0
Below 50	0	1
Median	73	72
St. dev.	8.6	9.2

$$r = \frac{+1781}{(44)(8.6)(9.2)} = +.51$$

$$P. E. = .08$$

	English III No. of Pupils (85)	Drawing III No. of Pupils (85)
95-99	0	3
90-94	1	24
85-89	16	42
80-84	25	14
75-79	17	2
70-74	14	0
65-69	5	0
60-64	6	0
55-59	1	0
Median	78	88
St. dev.	7.6	3.8

$$r = \frac{+653}{(85)(7.6)(3.8)} = +.27$$

$$P. E. = .07$$

The corresponding figure for the second year (English II and drawing II) was .13, and that for the first year (English I and drawing I) was .37. The coefficient for these two subjects in the third year is very low when compared, in general, with the coefficients for English III and other subjects in the third year.

ABILITIES OF HIGH SCHOOL PUPILS

	Latin III No. of Pupils (18)	German II No. of Pupils (18)
95-99	0	0
90-94	5	2
85-89	4	3
80-84	3	4
75-79	3	5
70-74	3	0
65-69	0	2
60-64	0	2
Median	85	79
St. dev.	7.2	9.3

$$r \text{ (for Latin III and German II)} = \frac{+767}{(18)(7.2)(9.3)} = +.64$$

$$\text{P. E.} = .09$$

	Latin III No. of Pupils (14)	French II No. of Pupils (14)
95-99	0	0
90-94	3	5
85-89	6	1
80-84	1	4
75-79	0	3
70-74	2	0
65-69	1	1
60-64	1	0
Median	87	84
St. dev.	10.5	6.6

$$r \text{ (for Latin III and French II)} = \frac{+92}{(14)(10.5)(6.6)} = +.09$$

$$\text{P. E.} = .18$$

This coefficient for Latin III and French II is extremely small, but as only a few pupils are concerned, this figure is not important.

	Latin III No. of Pupils (11)	Algebra II No. of Pupils (11)
95-99	0	2
90-94	3	1
85-89	3	1
80-84	1	3
75-79	2	2
70-74	2	2
Median	87	80
St. dev.	8.1	8.2

$$r = \frac{+426}{(11)(8.1)(8.2)} = +.58$$

$$\text{P. E.} = .13$$

	Latin III No. of Pupils (15)	History III No. of Pupils (15)
95-99	0	0
90-94	2	2
85-89	3	5
80-84	5	2
75-79	1	3
70-74	3	3
65-69	0	0
60-64	1	0
Median	82	84
St. dev.	8.6	6.7

$$r \text{ (for Latin III and history III)} = \frac{+161}{(15)(8.6)(6.7)} = +.19$$

$$P. E. = .17$$

	Latin III No. of Pupils (21)	Physics No. of Pupils (21)
95-99	0	0
90-94	6	3
85-89	8	3
80-84	2	8
75-79	2	3
70-74	2	1
65-69	1	2
60-64	0	1
Median	87	82
St. dev.	6.5	8.2

$$r \text{ (for Latin III and physics)} = \frac{+716}{(21)(6.5)(8.2)} = +.64$$

$$P. E. = .09$$

	Latin III No. of Pupils (22)	Drawing III No. of Pupils (22)
95-99	0	1
90-94	3	12
85-89	8	8
80-84	5	1
75-79	2	0
70-74	3	0
65-69	0	0
60-64	1	0
Median	85	91
St. dev.	7.9	3.4

$$r = \frac{+77}{(22)(7.9)(3.4)} = +.13$$

$$P. E. = .14$$

The corresponding figures for the second and first year for these two subjects were .03 and .34, respectively.

ABILITIES OF HIGH SCHOOL PUPILS

	German II No. of Pupils (29)	History III No. of Pupils (29)
95-99	0	0
90-94	1	7
85-89	7	6
80-84	4	5
75-79	6	3
70-74	6	3
65-69	2	3
60-64	3	2
Median	77	84
St. dev.	8.1	9.8

$$r = \frac{+1056}{(29)(8.1)(9.8)} = +.46$$

$$P.E. = .10$$

	German II No. of Pupils (19)	Physics No. of Pupils (19)
95-99	0	1
90-94	2	3
85-89	6	2
80-84	3	7
75-79	6	3
70-74	1	0
65-69	0	3
60-64	1	0
Median	81	82
St. dev.	7.4	8.0

$$r = \frac{+445}{(19)(7.4)(8.0)} = +.40$$

$$P.E. = .13$$

	German II No. of Pupils (16)	Bookkeeping II No. of Pupils (16)
95-99	0	1
90-94	0	2
85-89	2	0
80-84	3	2
75-79	6	5
70-74	4	3
65-69	1	2
60-64	0	1
55-59	0	0
Median	76	76
St. dev.	5.3	9.5

$$r = \frac{+491}{(16)(5.3)(9.5)} = +.61$$

$$P.E. = .11$$

The corresponding coefficient for German I and book-keeping I was .83.

	German II No. of Pupils (19)	Stenography and Typewrit- ing I. No. of Pupils (19)
95-99	0	0
90-94	0	0
85-89	2	2
80-84	4	1
75-79	6	3
70-74	6	4
65-69	1	6
60-64	0	2
55-59	0	1
Median	75	70
St. dev.	5.3	7.7

$$r = \frac{+270}{(19)(5.3)(7.7)} = +.35$$

$$P. E. = .13$$

	German II No. of Pupils (48)	Drawing III No. of Pupils (48)
95-99	0	2
90-94	2	10
85-89	7	24
80-84	7	10
75-79	17	2
70-74	9	0
65-69	3	0
60-64	3	0
Median	77	87
St. dev.	6.9	4.0

$$r = \frac{+171}{(48)(6.9)(4.0)} = +.13$$

$$P. E. = .10$$

This low coefficient tends to emphasize the already noticeable fact that the coefficients for drawing are smaller, in general, than those for other subjects. The corresponding coefficient in the second year for German I and drawing II was .12.

ABILITIES OF HIGH SCHOOL PUPILS

	French II No. of Pupils (18)	History III No. of Pupils (18)
95-99	0	0
90-94	7	2
85-89	5	2
80-84	6	4
75-79	0	4
70-74	0	2
65-69	0	2
60-64	0	1
55-59	0	0
50-54	0	1
Below 50	0	0
Median	88	79
St. dev.	3.9	10.4

$$r = \frac{+29}{(18)(3.9)(10.4)} = +.04$$

$$P. E. = .16$$

	French II No. of Pupils (17)	Physics No. of Pupils (17)
95-99	1	0
90-94	1	2
85-89	3	1
80-84	8	3
75-79	3	4
70-74	0	1
65-69	1	3
60-64	0	2
55-59	0	0
50-54	0	0
Below 50	0	1
Median	84	75
St. dev.	5.7	11.6

$$r = \frac{-191}{(17)(5.7)(11.6)} = -.17$$

$$P. E. = .16$$

Both of these coefficients are very small, but the small number of pupils concerned makes it possible for variations in the case of two or three individuals to affect greatly the result reached.

	French II No. of Pupils (12)	Stenography and Typewriting I. No. of Pupils (12)
95-99	0	0
90-94	3	2
85-89	4	0
80-84	2	0
75-79	3	3
70-74	0	4
65-69	0	2
60-64	0	0
55-59	0	1
Median	86	73
St. dev.	5.7	9.2

$$r = \frac{+309}{(12)(5.7)(9.2)} = +.49$$

$$P. E. = .15$$

	French II No. of Pupils (30)	Drawing III No. of Pupils (30)
95-99	1	0
90-94	9	9
85-89	6	18
80-84	8	2
75-79	6	1
70-74	0	0
65-69	0	0
60-64	0	0
55-59	0	0
Median	86	88
St. dev.	5.6	3.5

$$r = \frac{+72}{(30)(5.6)(3.5)} = +.12$$

$$P. E. = .12$$

	French II No. of Pupils (11)	Algebra II No. of Pupils (11)
95-99	1	2
90-94	1	1
85-89	2	0
80-84	5	2
75-79	1	1
70-74	0	2
65-69	1	3
60-64	0	0
55-59	0	0
50-54	0	0
Median	84	75
St. dev.	6.5	11.8

$$r \text{ (for French II and algebra II)} = \frac{+126}{(11)(6.5)(11.8)} = +.15$$

$$P. E. = .20$$

	German II No. of Pupils (10)	Algebra II No. of Pupils (10)
95-99	0	0
90-94	2	0
85-89	0	2
80-84	0	2
75-79	2	0
70-74	2	3
65-69	1	0
60-64	3	1
55-59	0	1
50-54	0	1
Median	72	72
St. dev.	10.6	11.1

$$r \text{ (for German II and algebra II)} = \frac{+559}{(10)(10.6)(11.1)} = +.48$$

$$\text{P. E.} = .16$$

	Algebra II No. of Pupils (15)	History III No. of Pupils (15)	Algebra II No. of Pupils (15)	Physics No. of Pupils (15)
95-99	1	0	1	0
90-94	0	1	1	2
85-89	1	4	2	1
80-84	2	2	2	4
75-79	2	2	2	3
70-74	2	2	2	2
65-69	2	2	3	2
60-64	1	2	0	1
55-59	1	0	0	0
50-54	3	0	2	0
Median	70	79	75	75
St. dev.	13.1	9.5	12.2	8.8

$$r \text{ (for algebra II and history III)} = \frac{+347}{(15)(13.1)(9.5)} = +.19$$

$$\text{P. E.} = .21$$

$$r \text{ (for algebra II and physics)} = \frac{+959}{(15)(12.2)(8.8)} = +.60$$

$$\text{P. E.} = .11$$

	Algebra II No. of Pupils (20)	Drawing III No. of Pupils (20)
95-99	1	0
90-94	0	5
85-89	2	14
80-84	4	1
75-79	2	0
70-74	3	0
65-69	3	0
60-64	1	0
55-59	1	0
50-54	2	0
Below 50	1	0
Median	71	87
St. dev.	13.3	2.6

$$r = \frac{+160}{(20)(13.3)(2.6)} = +.23$$

$$P. E. = .14$$

	History III No. of Pupils (18)	Physics No. of Pupils (18)
95-99	0	1
90-94	1	2
85-89	3	0
80-84	3	1
75-79	5	4
70-74	2	2
65-69	2	6
60-64	1	1
55-59	0	0
50-54	1	0
Below 50	0	1
Median	77	73
St. dev.	10.0	11.0

$$r = \frac{+1415}{(18)(10.0)(11.0)} = +.72$$

$$P. E. = .08$$

	History III No. of Pupils (15)	Sten. and Type. I No. of Pupils (15)
95-99	0	0
90-94	1	2
85-89	2	1
80-84	3	1
75-79	3	3
70-74	1	4
65-69	1	2
60-64	3	1
55-59	1	0
50-54	0	0
Below 50	0	1
Median	77	74
St. dev.	10.3	10.7

$$r = \frac{+558}{(15)(10.3)(10.7)} = +.34$$

$$P. E. = .15$$

	History III No. of Pupils (52)	Drawing III No. of Pupils (52)
95-99	0	3
90-94	9	12
85-89	10	28
80-84	9	7
75-79	9	2
70-74	6	0
65-69	5	0
60-64	3	0
55-59	0	0
50-54	1	0
Below 50	0	0
Median	82	87
St. dev.	9.8	3.9

$$r = \frac{+6}{(52)(9.8)(3.9)} = +.00$$

$$P. E. = .09$$

Again a low coefficient is shown for the subject of drawing.

	Physics No. of Pupils (28)	Drawing III No. of Pupils (28)
95-99	1	0
90-94	3	9
85-89	2	16
80-84	5	2
75-79	6	1
70-74	2	0
65-69	6	0
60-64	2	0
55-59	0	0
50-54	0	0
Below 50	1	0
Median	75	88
St. dev.	10.9	3.5

$$r = \frac{-46}{(28)(10.9)(3.5)} = -.04$$

$$P. E. = .13$$

This coefficient is practically zero, and agrees with the generally low figures reached for the subject of drawing.

	Sten. and Type. I No. of Pupils (27)	Bookkeeping II No. of Pupils (27)
95-99	0	1
90-94	1	3
85-89	3	0
80-84	0	3
75-79	4	7
70-74	7	5
65-69	8	4
60-64	1	4
55-59	3	0
Median	71	75
St. dev.	8.2	9.8

$$r = \frac{+1468}{(27)(8.2)(9.8)} = +.68$$

$$P. E. = .07$$

	Bookkeeping II No. of Pupils (24)	Drawing III No. of Pupils (24)
95-99	0	0
90-94	3	7
85-89	0	10
80-84	3	7
75-79	6	0
70-74	4	0
65-69	4	0
60-64	4	0
55-59	0	0
Median	75	86
St. dev.	9.3	3.6

$$r = \frac{+128}{(24)(9.3)(3.6)} = +.16$$

$$P. E. = .13$$

	Sten. and Type. I No. of Pupils (38)	Drawing III No. of Pupils (38)
95-99	0	0
90-94	3	9
85-89	2	19
80-84	1	10
75-79	7	0
70-74	12	0
65-69	8	0
60-64	2	0
55-59	3	0
Median	72	87
St. dev.	8.4	3.2

$$r = \frac{+104}{(38)(8.4)(3.2)} = +.10$$

$$P. E. = .11$$

Both of these coefficients for drawing are low, which agrees with what has already been noted.

A summary of the results found for the third-year subjects follows:

THIRD YEAR—121 GRADUATES

	Eng. III	Alg. II	Hist. III	Latin III	Ger. II	Fr. II	Physics	Bkg. II	Sten. and Typ. I	Draw. III
English III.....	—	.50 (21)	.55 (59)	.10 (35)	.45 (55)	.36 (33)	.69 (38)	.77 (26)	.51 (44)	.27 (85)
Algebra II.....	.50 (21)	—	.19 (15)	.58 (11)	.48 (10)	.15 (11)	.60 (15)	x	x	.23 (20)
History III.....	.55 (59)	.19 (15)	—	.19 (15)	.46 (29)	.04 (18)	.72 (18)	x	.34 (15)	.00 (52)
Latin III.....	.10 (35)	.58 (11)	.19 (15)	—	.64 (18)	.09 (14)	.64 (21)	x	x	.13 (22)
German II.....	.45 (55)	.48 (10)	.46 (29)	.64 (18)	—	x	.40 (19)	.61 (16)	.35 (19)	.13 (48)
French II.....	.36 (33)	.15 (11)	.04 (18)	.09 (14)	x	—	.17 (17)	x	.49 (12)	.12 (30)
Physics.....	.69 (38)	.60 (15)	.72 (18)	.64 (21)	.40 (19)	—	—	x	x	—
Bookkeeping II.....	.77 (26)	x	x	x	.61 (16)	.17 (17)	x	—	.68 (27)	.16 (28)
Sten. and Typ. I....	.51 (44)	x	.34 (15)	x	.35 (19)	.49 (12)	x	.68 (27)	—	.10 (38)
Drawing III.....	.27 (85)	.23 (20)	.00 (52)	.13 (22)	.13 (48)	.12 (30)	—	.16 (24)	.10 (38)	—

Note.—The figures in parentheses indicate the number of pupils in each case. Where less than 10 pupils are involved, no coefficient is given.

An inspection of this table will show many irregularities among the coefficients, particularly among those for the subject of French II. But the fact that only a few pupils took this subject makes it possible to explain the fluctuations in the size of its coefficients. As has been mentioned before, variation in the case of only a few pupils will tend to cause such marked irregularities. In general, it should be noted that the coefficients rank rather high, with the single exception of those for the subject of drawing. The distribution of the coefficients is as follows:

2	between .7 and .8
6	between .6 and .7
4	between .5 and .6
5	between .4 and .5
3	between .3 and .4
2	between .2 and .3
9	between .1 and .2
3	between 0 and .1
2	less than zero.

Twenty out of the thirty-six are greater than .3, and of the sixteen below .3, nine involve drawing as one of the subjects, and four of the remaining seven involve French II, which has been shown to have coefficients varying greatly in size. The points worthy of note in the third year results, are, then, the fact that so many of the coefficients are large, and the additional fact that each one of the nine coefficients involving drawing is small.

FOURTH YEAR RECORDS

In the fourth year there are no subjects that are compulsory for all pupils. The major subjects, from which each pupil is permitted to select four, are English IV, Latin IV, German III, French III, history IV, chemistry, zoology, astronomy, and stenography and typewriting II. Drawing IV and music IV, also, are elective.

	English IV No. of Pupils (78)	History IV No. of Pupils (78)
95-99	0	0
90-94	3	5
85-89	16	9
80-84	26	24
75-79	15	18
70-74	13	5
65-69	3	7
60-64	2	0
Median	81	79
St. dev.	6.5	6.6

$$r = \frac{+2198}{(78)(6.5)(6.6)} = +.66$$

$$P. E. = .04$$

The corresponding coefficient in the third year (for English III and history III) was .55.

	English IV No. of Pupils (28)	Latin IV No. of Pupils (28)
95-99	0	1
90-94	0	5
85-89	7	7
80-84	15	8
75-79	3	4
70-74	3	2
65-69	0	0
60-64	0	1
Median	83	84
St. dev.	4.6	6.9

$$r = \frac{+207}{(28)(4.6)(6.9)} = +.23$$

$$P. E. = .12$$

The corresponding coefficient for the third year (English III and Latin III) was .10.

	English IV No. of Pupils (16)	German III No. of Pupils (16)
95-99	0	0
90-94	0	1
85-89	3	1
80-84	4	2
75-79	4	6
70-74	4	3
65-69	1	2
60-64	0	1
Median	79	75
St. dev.	5.8	7.7

$$r = \frac{+124}{(16)(5.8)(7.7)} = +.17$$

$$P. E. = .16$$

The corresponding coefficient in the third year (for English III and German II) was .45.

	English IV No. of Pupils (15)	French III No. of Pupils (15)
95-99	0	0
90-94	2	2
85-89	4	8
80-84	6	2
75-79	1	3
70-74	2	0
65-69	0	0
60-64	0	0
Median	83	85
St. dev.	5.5	4.2

$$r = \frac{+257}{(15)(5.5)(4.2)} = +.74$$

$$P. E. = .08$$

The corresponding coefficient in the third year (for English III and French II) was .36.

	English IV No. of Pupils (41)	Chemistry No. of Pupils (41)
95-99	0	4
90-94	1	3
85-89	9	10
80-84	13	7
75-79	7	10
70-74	8	4
65-69	1	2
60-64	2	1
Median	81	83
St. dev.	6.9	8.2

$$r = \frac{+1296}{(41)(6.9)(8.2)} = +.56$$

$$\text{P. E.} = .07$$

	English IV No. of Pupils (16)	Zoology No. of Pupils (16)
95-99	0	0
90-94	0	1
85-89	3	2
80-84	5	5
75-79	4	4
70-74	2	1
65-69	2	1
60-64	0	2
Median	81	80
St. dev.	6.8	8.1

$$r = \frac{+386}{(16)(6.8)(8.1)} = +.44$$

$$\text{P. E.} = .14$$

	English IV No. of Pupils (18)	Astronomy No. of Pupils (18)	English IV No. of Pupils (29)	Drawing IV No. of Pupils (29)
95-99	0	0	0	4
90-94	2	0	2	14
85-89	5	2	4	9
80-84	6	1	11	2
75-79	2	3	4	0
70-74	3	3	6	0
65-69	0	3	1	0
60-64	0	6	1	0
Median	83	70	80	91
St. dev.	5.5	9.4	7.0	3.5

$$r = \frac{+510}{(18)(5.5)(9.4)} = +.55$$

$$\text{P. E.} = .11$$

The coefficient of correlation for English III and physics in the third year was .69.

$$r = \frac{-3}{(29)(7.0)(3.5)} = 0.00$$

$$\text{P. E.} = .12$$

Note the small coefficient which again occurs for the subject of drawing.

	History IV	Latin IV	History IV	German III
	No. of Pupils (24)	No. of Pupils (24)	No. of Pupils (20)	No. of Pupils (20)
95-99.....	0	1	0	0
90-94.....	3	4	0	0
85-89.....	4	5	2	2
80-84.....	11	7	6	4
75-79.....	2	3	2	4
70-74.....	2	2	5	5
65-69.....	2	0	5	3
60-64.....	0	2	0	2
Median.....	83	82	75	74
St. dev.....	6.3	8.0	7.3	7.3

$$r = \frac{+845}{(24)(6.3)(8.0)} = +.70$$

P. E. = .07

$$r = \frac{+422}{(20)(7.3)(7.3)} = +.40$$

P. E. = .12

	History IV	French III	History IV	Chemistry
	No. of Pupils (18)	No. of Pupils (18)	No. of Pupils (42)	No. of Pupils (42)
95-99.....	0	0	0	5
90-94.....	0	2	2	2
85-89.....	1	7	5	7
80-84.....	5	3	13	8
75-79.....	4	6	7	11
70-74.....	7	0	8	5
65-69.....	1	0	7	3
60-64.....	0	0	0	1
Median.....	77	84	79	81
St. dev.....	5.8	4.7	6.9	8.4

$$r = \frac{+147}{(18)(5.8)(4.7)} = +.30$$

P. E. = .14

$$r = \frac{+1694}{(42)(6.9)(8.4)} = +.70$$

P. E. = .05

	Hist. IV	Zoology	Hist. IV	Astronomy
	No. of Pupils (23)	No. of Pupils (23)	No. of Pupils (25)	No. of Pupils (25)
95-99	0	0	0	0
90-94	1	1	2	1
85-89	2	2	1	2
80-84	4	6	6	2
75-79	6	5	10	4
70-74	7	2	3	3
65-69	1	3	3	4
60-64	2	4	0	9
Median	75	78	78	68
St. dev.	7.1	9.0	6.9	10.2

$$r = \frac{+1068}{(23)(7.1)(9.0)} = +.73$$

P. E. = .07

$$r = \frac{+1331}{(25)(6.9)(10.2)} = +.76$$

P. E. = .06

	History IV No. of Pupils (40)	Drawing IV No. of Pupils (40)
95-99	0	4
90-94	1	18
85-89	5	16
80-84	7	2
75-79	13	0
70-74	10	0
65-69	2	0
60-64	2	0
Median	78	90
St. dev.	6.9	3.2

$$r = \frac{+270}{(40)(6.9)(3.2)} = +.31$$

P. E. = .10

	Latin IV	Chemistry	German III	Chemistry
	No. of Pupils (20)	No. of Pupils (20)	No. of Pupils (14)	No. of Pupils (14)
95-99.....	1	3	0	2
90-94.....	3	0	1	1
85-89.....	5	6	1	1
80-84.....	5	4	2	3
75-79.....	2	4	4	5
70-74.....	2	2	2	2
65-69.....	0	0	3	0
60-64.....	2	1	1	0
Median.....	84	84	75	80
St. dev.....	8.9	8.1	8.4	7.8

$$r = \frac{+1047}{(20)(8.9)(8.1)} = +.73 \quad r = \frac{+408}{(14)(8.4)(7.8)} = +.44$$

P. E. = .07 P. E. = .15

	Eng. IV	Sten. and Typ. II	German III	Sten. and Typ. II
	No. of Pupils (23)	No. of Pupils (23)	No. of Pupils (10)	No. of Pupils (10)
95-99.....	0	1	0	0
90-94.....	1	3	0	1
85-89.....	5	4	1	0
80-84.....	5	2	1	2
75-79.....	6	4	1	1
70-74.....	3	4	4	4
65-69.....	2	3	1	2
60-64.....	1	1	2	0
55-59.....	0	1	0	0
Median.....	79	77	71	73
St. dev.....	7.5	10.4	7.0	7.8

$$r = \frac{+1083}{(23)(7.5)(10.4)} = +.60 \quad r = \frac{+318}{(10)(7.0)(7.8)} = +.58$$

P. E. = .09 P. E. = .14

	Hist. IV	Sten. and Typ. II	Chemistry	Sten. and Typ. II
	No. of Pupils (41)	No. of Pupils (41)	No. of Pupils (11)	No. of Pupils (11)
95-99.....	0	2	0	0
90-94.....	3	3	0	0
85-89.....	2	5	0	0
80-84.....	9	4	2	2
75-79.....	9	9	5	2
70-74.....	13	9	2	4
65-69.....	4	6	2	2
60-64.....	1	2	0	1
55-59.....	0	1	0	0
Median.....	76	75	77	72
St. dev.....	7.1	9.4	5.4	5.8

$$r = \frac{+1675}{(41)(7.1)(9.4)} = +.61 \quad r = \frac{+144}{(11)(5.4)(5.8)} = +.42$$

P. E. = .07 P. E. = .17

	Zoology	Sten. and Typ. II	Astronomy	Sten. and Typ. II
	No. of Pupils (10)	No. of Pupils (10)	No. of Pupils (10)	No. of Pupils (10)
95-99.....	0	0	0	2
90-94.....	0	0	1	1
85-89.....	0	2	1	2
80-84.....	2	0	1	1
75-79.....	2	4	2	0
70-74.....	2	2	0	0
65-69.....	2	1	0	3
60-64.....	2	0	5	1
55-59.....	0	1	0	0
Median.....	72	77	70	86
St. dev.....	7.1	8.8	11.7	14.0

$$r = \frac{-219}{(10)(7.1)(8.8)} = -.35 \quad r = \frac{+1095}{(10)(11.7)(14.0)} = +.67$$

P. E. = .18 P. E. = .01

This negative coefficient is not specially significant as the number of pupils involved is very small. The variation due to a few individuals may account for the unusual value.

	Zoology	Drawing IV	Astronomy	Drawing IV
	No. of Pupils (10)	No. of Pupils (10)	No. of Pupils (12)	No. of Pupils (12)
95-99.....	0	0	0	3
90-94.....	0	5	0	5
85-89.....	1	5	1	2
80-84.....	4	0	2	2
75-79.....	3	0	1	0
70-74.....	1	0	1	0
65-69.....	0	0	3	0
60-64.....	1	0	4	0
Median.....	80	90	68	91
St. dev.....	7.1	3.0	9.8	4.2

$$r = \frac{+167}{(10)(7.1)(3.0)} = +.78$$

P. E. = .08

$$r = \frac{-13}{(12)(9.8)(4.2)} = -.03$$

P. E. = .19

This coefficient is very large, when compared with the usual one obtained for drawing. It should be noted, in this connection, that only ten pupils are included in this combination of subjects.

Again, a very low coefficient is obtained for drawing. The number of pupils concerned is small.

	Stenog. and Typ. II No. of Pupils (16)	Drawing IV No. of Pupils (16)
95-99	0	1
90-94	2	7
85-89	3	8
80-84	2	0
75-79	3	0
70-74	3	0
65-69	1	0
60-64	1	0
55-59	1	0
Median	78	90
St. dev.	9.5	2.8

$$r = \frac{-108}{(16)(9.5)(2.8)} = -.25$$

P. E. = .16

Another low coefficient for drawing.

A summary of all the coefficients for fourth year subjects follows:

FOURTH YEAR—121 GRADUATES

	Eng. IV	Hist. IV	Chem.	Zool.	Astron.	Latin IV	Ger. III	French III	Sten. and Typ. II	Draw. IV
English IV.....	—	.66 (78)	.56 (41)	.44 (16)	.55 (18)	.23 (28)	.17 (16)	.74 (15)	.60 (23)	.00 (29)
History IV.....	.66 (78)	—	.70 (42)	.73 (23)	.76 (25)	.70 (24)	.40 (20)	.30 (18)	.61 (41)	.31 (40)
Chemistry.....	.56 (41)	.70 (42)	—	x	x	.73 (20)	.44 (14)	x	.42 (11)	x
Zoology.....	.44 (16)	.73 (23)	x	—	x	x	x	x	— .35 (10)	.78 (10)
Astronomy.....	.55 (18)	.76 (25)	x	x	—	x	x	x	.67 (10)	— .03 (12)
Latin IV.....	.23 (28)	.70 (24)	.73 (20)	x	x	—	x	x	x	x
German III.....	.17 (16)	.40 (20)	.44 (14)	x	x	x	—	x	.58 (10)	x
French III.....	.74 (15)	.30 (18)	x	x	x	x	x	—	x	x
Sten. and Typ. II..	.60 (23)	.61 (41)	.42 (11)	— .35 (10)	.67 (10)	x	.58 (10)	x	—	— .25 (16)
Drawing IV.....	.00 (29)	.31 (40)	x	.78 (10)	— .03 (12)	x	x	x	— .25 (16)	—

Note.—The figures in parentheses indicate the number of pupils in each case. Where less than 10 pupils are involved, no coefficient is given.

From this table, we note the following:

7 coefficients are between .7 and .8
 4 coefficients are between .6 and .7
 3 coefficients are between .5 and .6
 4 coefficients are between .4 and .5
 2 coefficients are between .3 and .4
 1 coefficient is between .2 and .3
 1 coefficient is between .1 and .2
 1 coefficient is 0
 3 coefficients are negative.

Twenty out of the twenty-six coefficients are greater than

.3. The subjects having coefficients less than .3 are:

English IV	3 out of 9 coef. are less than .3
Latin IV	1 out of 3 coef. is less than .3
German III	1 out of 4 coef. is less than .3
Zoology	1 out of 4 coef. is less than .3
Astronomy	1 out of 4 coef. is less than .3
Stenography and typewriting II..	2 out of 7 coef. are less than .3
Drawing IV	3 out of 5 coef. are less than .3

It is worthy of note that drawing IV is the only subject having a majority of its coefficients less than .3.

SUMMARY

Grouping the coefficients of each year according to subjects and according to size of coefficients, we have the following tables of distribution for each year:

FIRST YEAR

	.8 to .9	.7 to .8	.6 to .7	.5 to .6	.4 to .5	.3 to .4	.2 to .3	Per Cent of Number of Coef. = .5 or More
English I.	..	..	2	..	I	2	..	40%
Algebra I.	..	..	..	..	..	4	I	0%
Latin I.	..	..	I	..	I	3	..	20%
History I.	I	..	2	..	I	I	..	60%
Science I.	I	..	2	..	..	2	..	60%
Drawing I.	..	..	I	..	I	2	I	20%

SECOND YEAR

	.8 to .9	.7 to .8	.6 to .7	.5 to .6	.4 to .5	.3 to .4	.2 to .3	.1 to .2	0 to .1	-.1 to 0	Per Cent of No. of Coef. = .5 or More
English II.	..	..	2	2	..	3	..	2	..	..	44%
Geometry I.	..	..	..	2	..	3	..	I	..	..	33%
Latin II.	..	..	..	3	I	..	..	..	I	..	60%
German I.	I	..	..	2	..	2	I	I	..	..	43%
French I.	..	..	..	I	I	I	..	..	..	I	25%
History II.	..	I	..	I	..	I	..	..	..	..	67%
Bkg. I.	I	..	..	..	3	..	..	I	..	..	20%
Com. Arith.	..	I	..	I	I	..	2	..	..	..	40%
Com. Geog.	..	2	..	2	I	..	..	..	..	..	80%
Drawing II.	..	2	..	..	I	..	I	3	I	I	22%

THIRD YEAR

	.7 to .8	.6 to .7	.5 to .6	.4 to .5	.3 to .4	.2 to .3	.1 to .2	0 to .1	-.1 to 0	-.2 to -.1	Per Cent of No. of Coef. = .5 or More
English III.	I	I	3	I	I	I	I	..	..	..	56%
Latin III.	..	2	I	..	..	..	3	I	..	..	43%
German II.	..	2	..	4	I	..	I	..	..	..	25%
French II.	..	..	..	I	I	..	2	2	..	I	0%
Algebra II.	..	I	2	I	..	I	2	..	..	..	43%
History III.	I	..	I	I	I	..	2	2	..	..	25%
Physics.	I	3	..	I	..	..	..	..	I	I	57%
Bookkeeping II.	I	2	..	..	..	..	I	..	..	..	75%
Sten. & Typ. I.	..	I	I	I	2	..	I	..	..	..	33%
Drawing III.	..	..	..	..	..	2	5	I	I	..	0%

FOURTH YEAR

	.7 to .8	.6 to .7	.5 to .6	.4 to .5	.3 to .4	.2 to .3	.1 to .2	0 to .1	-.1 to 0	-.2 to -.1	-.3 to -.2	-.4 to -.3	Per Cent of No. of Coef. = .5 or More
English IV....	1	2	2	1	..	1	1	1	..	..	..	..	56%
History IV....	4	2	..	1	2	..	..	..	..	..	..	..	67%
Latin IV.....	2	..	..	..	..	1	..	..	..	..	..	..	67%
German III....	..	..	1	2	..	..	1	..	..	..	..	..	25%
French III....	1	..	..	..	1	..	..	..	..	..	..	..	50%
Chemistry....	2	..	1	2	..	..	..	..	..	..	..	..	60%
Zoology.....	2	..	..	1	..	..	..	..	..	..	1	..	50%
Astronomy....	1	1	1	..	..	..	..	1	..	..	..	..	76%
Sten. and Typ. II.....	..	3	1	1	..	..	..	..	..	1	1	..	57%
Drawing IV...	1	..	..	..	1	..	..	1	1	..	1	..	20%

If we combine the results as shown by the four preceding tables, we have the following table showing the distribution according to departments and size of coefficients.

SUMMARY OF ALL FOUR YEARS

	.8 to .9	.7 to .8	.6 to .7	.5 to .6	.4 to .5	.3 to .4	.2 to .3	.1 to .2	0 to .1	-.1 to 0	-.2 to -.1	-.3 to -.2	-.4 to -.3	Total No. of Coef.	No. of Coef. = .5 or More	No. of Coef. = .3 or More	Per Cent of No. of Coef. = .5 or More
English.....	..	2	7	7	3	6	2	4	1	..	..	..	..	32	16	25	50%
Mathematics..	..	..	1	4	1	7	2	3	..	..	..	..	..	18	5	13	28%
History.....	1	5	5	2	3	5	..	2	2	..	..	..	..	25	13	21	52%
Science.....	2	5	6	2	4	2	..	..	2	1	..	1	..	25	15	21	60%
Foreign languages..	1	3	5	8	10	9	2	8	4	1	1	..	..	52	17	36	33%
Commercial..	1	1	9	6	7	2	2	3	..	..	1	1	..	32	16	25	50%
Drawing.....	..	1	3	..	2	3	4	8	3	3	..	1	..	28	4	9	14%
Total.....	..	..	..	..	..	..	..	..	..	..	..	..	..	212	86	150	41%

This table shows that a total of 150 out of the 212 coefficients are equal to .3 or more, and that 86 of them are equal to or greater than .5. This is evidence that there is a considerable correlation among the records of these pupils. Indeed, if we bear in mind that the coefficient of correlation between English II and English I was .83, that between Latin II and Latin I was .63, that between geometry I and algebra I was .63, and that between drawing II and draw-

ing I was .55, we have good reason for considering coefficients of .3 or greater as having significance.

The next point to consider is the probable cause of this correlation, as shown in the school records. This may be due either to "spread of ability," as claimed by the advocates of the doctrine of formal discipline, or to the similarity among subjects. The latter does not necessarily imply resemblance of content, but it may be based upon the fact that the school procedure is very much the same in most subjects, and that success in most subjects in school is based upon doing almost the same sort of thing in each subject. That the correlation, which we have found to exist, probably does not depend upon the "spread of ability" but upon similarity among subjects, is shown by the very small amount of correlation between drawing and other subjects. An examination of the last table will show that out of 28 coefficients for the subject of drawing, only four are equal to .5 or more, and only nine are equal to or greater than .3. Here we have a subject, considerably different from the so-called "academic" subjects, and it shows this difference by a strikingly low amount of correlation with the other subjects. It may be claimed that typewriting, being considerably different from the "academic" subjects, should show little correlation with them. In the school records which have been used, the records in the subjects of stenography and typewriting have been combined, and any difference in correlation due to typewriting may be covered up by the opposite effect due to stenography.

Since there is considerable correlation among the subjects, the practical question arises, Can we not estimate the general standard of a pupil in school by the grade which he has attained in some one subject? In most schools in which the elective system is in force, promotion is made upon a subject basis. In other cases, it may be desirable to know what subject will best indicate the progress of a pupil. The last table shows that 60 per cent of all the coefficients for science, 52 per cent of those for history, 50

per cent of those for English, and 50 per cent of those for commercial subjects, are equal to or greater than .5. The other subjects rank lower. If we should use the record of a pupil in a single department to form the basis for our estimate, it should be one of these four departments. In the case of science, there are several branches included (physics, chemistry, zoology, astronomy, physical geography, and botany), and there is much variation among these. Moreover, the number of pupils involved in the calculation of some of these coefficients is small. If we consider history, we find some of the high coefficients occur for history II, in which subject there were few pupils. In addition, as the number of pupils taking history in any year is smaller than the number taking English, it is only natural to assume that the coefficients based upon the larger number of individuals are more worthy of consideration. The commercial department includes various subjects, and the number of pupils is, again, smaller than the number studying English. Since English has the largest number of pupils, and, moreover, since its coefficients rank so high (50 per cent of them are equal to or greater than .5), it seems to be the subject best fitted to form the basis of judgment of a pupil's school progress. In this connection, we should bear in mind, also, that a coefficient of .72 was found between the general average in the first year and the subject of English I.

PART II

Further study of the subject of correlation of pupils' abilities was undertaken in the following manner. Two groups of pupils in the first year class were chosen. These were pupils who had entered the school in September, 1915. One group was composed of pupils taking an academic course, the other included those who had chosen a commercial course. The pupils were not selected upon the basis of ability, but were taken in alphabetical order from the total number studying the same combination of subjects. There were 30 pupils in the academic group, and 29 in the commercial. These pupils were given three different tests, which have been used elsewhere in investigations of the abilities of individuals. The results of these tests have been correlated with the semester marks of the several subjects studied by the pupils. The purpose of this part of the investigation is to ascertain the amount of correlation existing between ability as measured in terms of these tests and ability as shown by school grades.

The first test given was the Trabue completion test (see Trabue, "Completion Test Language Scales," 1916). Two language scales were used, L and M.

Test L consists of eight incomplete sentences to be filled out by the pupil. The sentences are the following:

TRABUE LANGUAGE SCALE L

60. Children are rude not easily win friends.
66. Plenty exercise and air healthy
and girls.
70. In to maintain health, one should have nour-
ishing
65. happiness can not be with money.
32. One's do always express his thoughts.

92. To to wait, after having to go,
 very annoying.
78. It is sometimes to between two
 of action.
97. One can..... do his at one while
 of another.

Test M consists of eight sentences similar in nature to those of test L. These sentences are:

TRABUE LANGUAGE SCALE M

67. One can not foretell will happen in the
59. The dog a useful because his
 intelligence and faithfulness.
95. Many people their health because do not
 the of hygiene.
79. Nothing can one's happiness effectively than
 a guilty
45. To many things ever finishing any of them
 a habit.
91. The seems and dreary a
 discouraged
55. that are to one by an friend should
 be pardoned readily than injuries done by one
 is not angry.
88. It is that a full-grown man should a ghost
 he is

The time allowed for each test was five minutes. Each sentence was marked 2, 1, or 0, in accordance with the manner in which the blank spaces had been filled.

The second test was what is known as the word-opposite test. Forty words were given to the pupils, and they were required to state, as far as possible, the exact opposite of each one. The words used are those given in lists A and C in Whipple, Manual of Mental and Physical Tests.

The lists are as follows:

List A

bad
inside
slow
short
little
soft
black
dark
sad
true
dislike
poor
well
sorry
thick
full
peace
few
below
enemy

List C

stupid
hard-working
strong
sane
obnoxious
foolish
handsome
adroit
superior
loquacious
rapid
generous
straight
separate
up
always
joy
high
obscure
proud

The time allowed was just about enough for the quickest to finish. The answers were marked 1, $\frac{1}{2}$, or 0.

The third test was in the cancellation of a single letter, *a*, (see Test 26, Whipple, Manual of Mental and Physical Tests). Each pupil was given paper upon which were printed 100 of each of the 26 letters of the alphabet, arranged in chance order.

hplgvjembsfgtcdbvzmzkfhfpoiabgjflurcqihdjoabkvt
ndefxkjcdtmwlfzeojqlfhycijwpzhkeqfvyzlsxfvrjy
mxniuifktvxpyralkjowqfvpystexralpbicrdjfuqzihg
pskdcmosgfyqwepkasditogmqkftshbdrpzvxqfuid
tohxwaklbvxzfoearlsjvqfuoltdapqevkmtpuodszejwg
xfvozpkqrbeftkxrvjybuacdsbwumehrcdxygjwhblft
yekdwzvxbpokwizedgowacpkmjrhltoivdaxkhmwz

ytejscqioxhtfayubltrezipwmslbjgevxniwoybhazfkm
 tndrbuclmteazyjgivptwohswfzyqrhlnejozptqkba
 msofcvukbijpcyfaoujzmlkrvxptcndsoaljyrbcvzsgu
 yknbfcgzjprinrkdfgawulcrkgdfuiqkaczymbdxfqokz
 nwujpgredlzpnpjxgdfzemojndxcizwbjgdghvusiqod
 zbuecgtppkuwljorbkspwujtoebnmwadfsvnkubroljw
 icuofnaedjxcgvznlsfjbhzruxnfmodhycvsqrufgdaie
 xmphfdoqcretbmivlcdnfhqkgpxoasvyntxbqpfhvn
 ekdzjrylqamsptkgzonieusyrpnqzcsvtuigyfkpzsndt
 vkbpasynjxhobuywqzcljgyrovdwnmuqkfxihyvga
 jwlusnmxbgtyikpaugxltymbingusxyrpmhgvbzlxce
 wgtjfablhxmqsynaziegmxyqjdnxlebztagmahfioqus
 rtmhlciqagnyrtcljhinrbmqepglcsvmrwxpcqzbtaks
 nylvxgzodcabeximnfyutjrxnzhwbdipecolevxintmhwp
 lymgdwrakivqyselwdfikuhsvgdcimwopvqkinudwr
 htlvxsizcldqwpjuzrachwivsrmyubevpnigoqsmvzer
 uysmxanigzveqxrwpwsnltxzujwgakmehlcybnkpwv
 oahyispktgcmnqzsejiucodrheshbgufmxopnqckegmu
 xatkohjbeavupsrmtxqwkhhbcoryuaqhimzkwbngjria
 ldevcbtqnwlxdzrfecgrpinajhxtqkyiwmucogolkebam
 qrgnvjswhdexcormuplhqrnzetwblhcgtrtjamlfhycxr
 bovdzndyheilavcfonyhxatzwgnhjfmowbpxhtsdfev
 wimngsaectjqwhftypdos.

zcyuwtgjikhmhzsjnquocvdjlkutwnrsxyeuhtnrpxav
 ehtwzcrypxfakvrnuhmgdayxiljegrzscbpoqmyegn
 dtjicsenhuvfioxaqdemcryaidzqweonvmraughscnip
 wlamkveoixtygnrhlexyvgqnbmikpawszcvmtijbezs
 cykrwdzqlxkrmlhzbpevlfszoahrfbymwunegbqvuw
 rymogsewpcfmxsxiwcktaorhxdgkflnpvtjsgdmnv
 wypjxmhzofojnyakehqlgusxndpzahjkvulwydnzbx
 lrehgazjsymkxzqwpthsegblnijxrwvlmqiactwpzliem
 oyfduzljncaimwsrindybakxgedmphnujblamptxzsr
 lycaxfgzsmtainyxhjdstwmygvplactwodsneighbvnf
 wxprseyhcfllwtqxzibofswdcijnztxskidoqfugscrmpo
 aglqxepvfntycauqhimmjxkobtahlexqnftvkdaelubi
 qfdalgetvwvhboimtnwsklovhceuwpyknzovshtyzwic

rdpljvihoubprtiazwfnpmISOedkxtlngrbjkpfngixycw
 vgfvtpebxaorihncdoaqiftbhswaupfqniegrpybblinodecq
 rszjfgauilohvqafceujzgtndvaosjbiphtlsbcmuwtpks
 ymdiuhfvsxlrqapibxodsateqxrbkuivozgbreskuxov
 lqdjhuafoxevwdrqcglnjeomwtxiucyfjzmqblhdnifvct
 axsezryfngovhtzjuasikbztldwlhkjznvyawqlexkjbyr
 oxzmmwkqntbcjpoghzdtrqyevjscrftxwpgdkecfjwyg
 bzshiuyfrwgpbednzckibhxvgwfmruqjpwexmvgup
 fbhnmittldwusxgckyrantsucogrmfdqyuopkzacnvsp
 umdyltksbzuphnfwigbluqhdmjitgoadfrhkjebaiqgz
 mkuwpnqzymjcsulxayokrvuxfmqjohbkzuyqlofrw
 xgeszlbfbvhdezropvqadkcxfulybqpdjstirmhfqvkcgj
 aewmxtckrbqyxjlopncvkdbrpuaözvymnrudjthzpqo
 bykfdavolbysemcpluofgmrbkapomtczqefiwxhlvob
 jpradhgwkgqbrvdypfsgkteuvjqnftcbjwulihmpxdrkq
 ebzyfgjusohqdyfkciumeqjxaokvnswjpychfzgleqm
 cwxiptdkotbmjvgrydkcfoslq

The time allowed was just about enough for the quickest to finish. The single index of net efficiency, E , was computed as follows:

$E = SA$, where S = the speed index (ground covered)

A = the accuracy index

$A = \frac{c - w}{c + o}$, where o = no. of letters erroneously omitted

c = no. of letters crossed

w = no. of letters wrongly crossed.

The results of the several tests are given in the following table. Each pupil is indicated by a Roman numeral.

ACADEMIC GROUP

Pupil	Trabue L	Trabue M	Trabue- Total	Easy Opp.	Hard Opp.	Opp.— Total	Cancel- lation
I.....	3	9	12	20	13	33	1956
II.....	5	11	16	20	14	34	2020
III.....	7	8	15	19½	12½	32	1642
IV.....	8	2	10	19	11½	30½	2574
V.....	9	10	19	19	14	33	2072
VI.....	3	2	5	19	3½	22½	2054
VII.....	11	5	16	18½	12½	31	2271
VIII.....	4	7	11	19	7½	26½	1700
IX.....	5	9	14	19	12	31	2548
X.....	8	4	12	18	11½	29½	2131
XI.....	5	8	13	16	8½	24½	1545
XII.....	9	10	19	20	5	25	1302
XIII.....	8	4	12	19	10½	29½	2143
XIV.....	4	5	9	16	6	22	1626
XV.....	10	8	18	20	11½	31½	1540
XVI.....	9	11	20	20	16	36	2113
XVII.....	5	5	10	19½	11	30½	2522
XVIII.....	7	7	14	18	10½	28½	2444
XIX.....	6	12	18	18	14½	32½	1761
XX.....	8	10	18	17½	12	29½	2548
XXI.....	11	13	24	18½	17	35½	1640
XXII.....	8	9	17	19	11	30	1454
XXIII.....	6	8	14	16	11	27	1778
XXIV.....	12	9	21	19½	15	34½	1340
XXV.....	7	5	12	19	13½	32½	1611
XXVI.....	3	7	10	19	11½	30½	1191
XXVII.....	6	6	12	18½	10½	29	2240
XXVIII.....	9	12	21	20	14	34	1838
XXIX.....	11	11	22	18	11½	29½	1470
XXX.....	4	8	12	20	10½	30½	1460

COMMERCIAL GROUP

Pupil	Trabue L	Trabue M	Trabue Total	Easy Opp.	Hard Opp.	Opp. Total	Cancel- lation
XXXI.....	11	10	21	19½	16½	36	1538
XXXII.....	5	8	13	20	10½	30½	1987
XXXIII.....	6	10	16	20	14	34	1425
XXXIV.....	12	6	18	20	11	31	2054
XXXV.....	11	9	20	20	14	34	1808
XXXVI.....	8	7	15	19½	10½	30	1213
XXXVII.....	6	3	9	20	7	27	1504
XXXVIII.....	6	5	11	18	5	23	1573
XXXIX.....	9	9	18	19½	12½	32	1635
XL.....	10	9	19	20	15½	35½	1865
XLI.....	11	10	21	16½	6½	23	1890
XLII.....	11	12	23	20	15	35	1465
XLIII.....	8	4	12	19	6½	25½	1536
XLIV.....	7	6	13	20	10½	30½	1384
XLV.....	9	8	17	20	3	23	1640
XLVI.....	11	10	21	19½	14½	34	1165
XLVII.....	2	5	7	17	7	24	1636
XLVIII.....	9	12	21	20	14	34	1238
XLIX.....	5	6	11	16½	5½	22	2147
L.....	11	6	17	20	9½	29½	1502
LI.....	9	9	18	19½	14	33½	1695
LII.....	10	12	22	18	11	29	2279
LIII.....	9	12	21	18	12	30	1984
LIV.....	7	11	18	19	14	33	2015
LV.....	11	7	18	20	14	34	1300
LVI.....	10	7	17	18	11	29	2470
LVII.....	10	7	17	19	14	33	2006
LVIII.....	12	12	24	19	13½	32½	1958
LIX.....	8	7	15	18	13	31	1918

The school grades in each subject are given in the following tables:

ACADEMIC GROUP

Pupil	Eng. I	Alg. I	Hist. I	Latin I	Draw. I
I.....	79	78	73	73	91
II.....	80	87	58	82	80
III.....	74	95	70	88	69
IV.....	75	98	81	94	84
V.....	77	83	65	57	84
VI.....	65	57	58	57	87
VII.....	75	77	62	69	81
VIII.....	65	95	80	92	71
IX.....	64	86	69	86	65
X.....	67	74	45	64	74
XI.....	72	57	55	52	83
XII.....	78	78	64	94	65
XIII.....	69	97	63	75	80
XIV.....	70	67	64	65	73
XV.....	77	92	83	81	76
XVI.....	87	94	78	85	81
XVII.....	68	62	63	83	72
XVIII.....	70	61	77	74	72
XIX.....	72	60	64	66	63
XX.....	75	64	61	55	86
XXI.....	72	95	71	78	76
XXII.....	88	94	83	80	81
XXIII.....	57	78	61	77	77
XXIV.....	73	87	85	92	88
XXV.....	69	74	58	58	77
XXVI.....	69	74	58	58	77
XXVII.....	70	84	63	68	73
XXVIII.....	85	96	64	77	87
XXIX.....	76	95	76	85	84
XXX.....	54	86	72	71	74

COMMERCIAL GROUP

Pupil	Eng. I	Bkpg. I	Com. Arith.	Sten. I	Typ. I	Draw. I
XXXI.....	65	88	90	86	99	78
XXXII.....	65	60	64	70	91	80
XXXIII.....	83	84	85	77	76	73
XXXIV.....	62	65	83	61	78	85
XXXV.....	67	75	58	68	48	88
XXXVI.....	61	83	78	73	91	90
XXXVII.....	52	64	68	70	57	80
XXXVIII.....	59	78	85	83	90	88
XXXIX.....	77	69	90	74	93	80
XL.....	80	87	98	85	93	90
XLI.....	74	79	70	75	63	88
XLII.....	80	81	99	95	96	85
XLIII.....	63	66	75	72	66	85
XLIV.....	63	75	86	73	97	90
XLV.....	57	66	60	79	35	89
XLVI.....	75	83	99	82	60	88
XLVII.....	57	71	78	59	41	83
XLVIII.....	74	77	62	71	90	65
XLIX.....	51	47	45	82	34	63
L.....	75	82	66	81	88	80
LI.....	72	87	82	77	72	85
LII.....	67	75	72	56	34	75
LIII.....	58	65	65	56	30	75
LIV.....	80	88	84	86	66	88
LV.....	63	65	90	67	55	78
LVI.....	73	80	88	82	50	75
LVII.....	82	86	98	85	97	93
LVIII.....	80	93	94	96	93	90
LIX.....	64	82	85	62	60	88

The medians and standard deviations are indicated in the following tables:

ACADEMIC GROUP

	Trabue Test	Opp. Test	Cancell. Test	Eng. I	Alg. I	Hist. I	Lat. I	Draw. I
Maximum....	32	40	2600	100	100	100	100	100
Median.....	14	30.5	1808	72	84	64	76	77
St. dev.....	4.5	3.5	408.4	7.5	13.5	10.1	12.4	7.1

COMMERCIAL GROUP

	Trabue Test	Opp. Test	Cancell. Test	Eng. I	Bkpg. I	Com. Arith.	Sten. I	Typ. I	Draw. I
Maximum....	32	40	2600	100	100	100	100	100	100
Median.....	18	31	1640	67	78	83	75	72	85
St. dev.....	4.3	4.2	334.9	9.1	10.5	14.3	10.3	22.4	7.8

The coefficients of correlation found are as follows:

ACADEMIC GROUP

	Trabue Test	Opposite Test	Cancellation Test.
English I.....	.52	.40	-.02
Algebra I.....	.35	.49	-.20
History I.....	.37	.23	-.06
Latin I.....	.28	.25	-.06
Drawing I.....	.11	.16	.03

COMMERCIAL GROUP

	Trabue Test	Opposite Test	Cancellation Test
English I.....	.56	.59	.05
Bookkeeping I....	.50	.55	-.16
Com. Arith.....	.32	.56	-.20
Stenog. I.....	.25	.20	-.08
Typewriting I....	.16	.55	-.37
Drawing I.....	.11	.12	-.16

ACADEMIC GROUP

	English I	Algebra I	History I	Latin I	Drawing I
English I.....	—	.22	.20	.19	.37
Algebra I.....	.22	—	.42	.65	.09
History I.....	.20	.42	—	.57	.13
Latin I.....	.19	.65	.57	—	-.22
Drawing I.....	.37	.09	.13	-.22	—

COMMERCIAL GROUP

	Eng. I	Bkpg. I	Com. Arith.	Stenog. I	Typ. I	Draw. I
English I.	—	.69	.52	.54	.50	.15
Bookkeeping I.	.69	—	.66	.48	.50	.50
Com. Arith.	.52	.66	—	.38	.52	.53
Stenog. I.	.54	.48	.38	—	.51	.21
Typewriting I.	.50	.50	.52	.51	—	.31
Drawing I.	.15	.50	.53	.21	.31	—

If we consider the coefficients of correlation between the results of the completion test and the school grades, we find in the academic group a fair amount of correlation, with the exception of the coefficients obtained for drawing. These results, in general, confirm those found in Part I of this study. It is not surprising that the results of a language-scale test should correlate more closely with English than with the other subjects. The coefficients found for the completion test with the school marks of the commercial group show, again, that English has the highest coefficient and drawing the lowest. Typewriting, which offers many points of dissimilarity with the other subjects, gives a low coefficient also.

Proceeding to the results obtained in correlating the marks made in the opposite test with the school grades, we find for the academic group that drawing gives the lowest figure, and English next to the highest. For the commercial group, drawing again ranks lowest, and English highest. Typewriting, however, ranks high, and does not agree with the result found for the completion test.

The results of the cancellation test, when correlated with the school grades, show great irregularities when compared with the figures for the other tests. The cancellation test, itself, has for some time been regarded not as highly as the other types, and accordingly the coefficients obtained for it can not be looked upon as possessing great importance.

An inspection of the correlation coefficients for the school grades among themselves, shows that drawing ranks lowest for both groups of pupils, a fact which confirms the results

of Part I of this study. The figures for English rank high for the commercial group, but not for the academic. It should be remembered that these coefficients are based upon the marks of the first semester, and can not be considered as important as those in Part I, which are calculated from the records of a full year, and for each year of the course.

SUMMARY OF CONCLUSIONS

1. This study of the coefficients of correlation among school grades shows a considerable amount of correlation, 71 per cent of all the coefficients being equal to or greater than .3, and 41 per cent being equal to or greater than .5.

2. Drawing ranks lowest among all the subjects, the size of the coefficients being taken as a basis.

3. The correlation, as found, may be due either to a "spread of ability" or to resemblance of elements among the several school subjects. Since drawing, a subject very unlike the other ones, shows low coefficients, the correlation is probably due to resemblance of elements among the subjects, or at least of those things counting for success in school.

4. If it is desired to use a single subject as the basis of judgment of school progress, English is probably the best one to select for this purpose.

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APPENDIX

TABLES SHOWING THE CORRELATION EXISTING BETWEEN RECORDS MADE IN THE SUBJECTS OF THE FIRST YEAR COURSE

TABLE SHOWING CORRELATION OF RECORDS IN ENGLISH I AND ALGEBRA
I FOR 121 GRADUATES

Algebra I	English I							
	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94
	55-59		1	1	1	1		
	60-64		1	2	3			
	65-69		1	3	1	3		2
	70-74		1	3	5	3	1	
	75-79		1	8	4	7	3	
	80-84		1	3	7	7	4	2
	85-89	1		1	4	1	10	1
	90-94			1	2	5	5	5
	95-99					2	1	2

ENGLISH I AND LATIN I (87 GRADUATES)

English I	Latin I										
	Below 50	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	60-64			1				1			
	65-69	1			3	4	3	2	2		
	70-74	1		2	3	2	3	3	1	1	
	75-79	1		1		4	6	2	6	4	1
	80-84		1		1		3	10	1	3	3
	85-89					1				5	1

SCIENCE I AND ENGLISH I (61 GRADUATES)

Science I

English I		50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	55-59	I									
	60-64				I	I	2				
	65-69				2	4		2	I		
	70-74		2		4	3	3		3		
	75-79			I		3	3	2	2		
	80-84					2	3	4	3	2	
	85-89							I	I	2	I
	90-94							I		I	

SCIENCE I AND ALGEBRA I (61 GRADUATES)

Science I

Algebra I		50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	55-59		I					2			
	60-64					I					
	65-69				I	2	2	2		I	
	70-74		I		I	4	5				
	75-79				3	2	3	2			
	80-84			I	I	2	I		3	I	
	85-89	I			I	I		2	6	I	
	90-94					I		I	I	I	I
	95-99							I		I	

SCIENCE I AND DRAWING I (61 GRADUATES)

Science I

Drawing I		50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	65-69	I			2						
	70-74		I		I	2	3				
	75-79		I	I	3	6		2	2		
	80-84				I	4	4	3	3	3	
	85-89					I	4	5	3	2	I
	90-94								2		

ENGLISH I AND DRAWING I (121 GRADUATES)

English I

Drawing I		55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94
	55-59				I				
	60-64								
	65-69	I		2	3				
	70-74		I	2	4	6	3	I	
	75-79			6	II	6	6	2	
	80-84		3	7	4	II	II	3	I
	85-89			3	2	6	7	4	I
	90-94				I	I	I		

ALGEBRA I AND DRAWING I (121 GRADUATES)

Algebra I

Drawing I		55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	55-59						I			
	60-64									
	65-69		I	I	2			2		
	70-74	I	2	I	3	5	I	2	2	
	75-79	I		2	2	8	10	4	3	I
	80-84	I	3	3	4	7	8	4	7	3
	85-89	I		3	2	2	4	5	5	I
	90-94					I		I	I	
	95-99									

HISTORY I AND ALGEBRA I (93 GRADUATES)

History I

Algebra I		Below 50	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	55-59					I		I			I	
	60-64				I	2	I	2				
	65-69						2	I	I	2	2	
	70-74						3	I	I	I		
	75-79			2	I	I	3	2	5	I	I	
	80-84	I			I	2	4	2	4	6	2	
	85-89				I		I		5	3	3	I
	90-94						I	2	2	2	5	2
	95-99								I	I	I	I

LATIN I AND SCIENCE I (27 GRADUATES)

Latin I

Science I		55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	55-59					I				
	60-64									
	65-69	I			I		I			
	70-74		I	I	2		2			
	75-79	I				I	2	I	I	
	80-84			I		3				I
	85-89				I	I	I	2		
	90-94								I	

LATIN I AND DRAWING I (88 GRADUATES)

Latin I

Drawing I		Below 50	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
	55-59	I										
	60-64											
	65-69						I	2	I	I		
	70-74	2	I		I		2	2	3	I	I	
	75-79					2	5	5	5		3	3
	80-84			2	2	3	3	3	5	5	5	2
	85-89					I	2	3	2	2	4	
	90-94								I	I		

HISTORY I AND SCIENCE I (33 GRADUATES)

History I

	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
50-54		I							
55-59			I						
60-64			I						
65-69	I			2	I				
70-74			I	4	2				
75-79					I		2	I	
80-84						I	I	2	
85-89						4	I	I	
90-94							I	I	2
95-99								I	

Science I

GENERAL AVERAGE AND ENGLISH I (121 GRADUATES)

General Average

	60-64	65-69	70-74	75-79	80-84	85-89	90-94
55-59	I						
60-64		2	I	I			
65-69	I	5	10	4			
70-74	2	4	10	6	4		
75-79	I	I	5	9	7	6	I
80-84			2	5	11	8	2
85-89					2	3	5
90-94					2		

English I

GENERAL AVERAGE AND ALGEBRA I (121 GRADUATES)

General Average

Algebra I		60-64	65-69	70-74	75-79	80-84	85-89	90-94
	55-59	1		3				
	60-64	1	2	3				
	65-69		3	2	2	3		
	70-74		3	7	2		1	
	75-79	1	3	7	7	3	2	
	80-84	1	1	5	7	7	3	
	85-89	1		1	5	7	4	
	90-94				2	5	5	6
	95-99					1	2	2

VITA

David Emrich Weglein was born in Baltimore, Md., on June 10, 1876. He was educated in the public elementary schools of Baltimore, and was graduated at the Baltimore City College in 1894, with a rank of first in the class. He matriculated in the collegiate department of Johns Hopkins University in 1894, and as a result of a competitive examination he was awarded the first Hopkins scholarship for the year 1894-95. He won Hopkins scholarships in the years 1895-96 and 1896-97, also. In June, 1897, he received the degree of Bachelor of Arts, and was awarded a University scholarship. In the spring of 1897, he was elected a member of Phi Beta Kappa. From 1908 to 1914, he pursued graduate work in Columbia University. In October, 1912, he received the degree of Master of Arts at Columbia University, and the Master's Diploma in Education at Teachers College, Columbia University. In the summer session of 1914, he was Assistant in Educational Administration at Columbia University. From 1908 to 1916 he pursued graduate work in Johns Hopkins University. From 1897 to 1900 he was first assistant in a male grammar school, Baltimore; from 1900 to 1902, instructor in the Training School for Teachers; and from 1902 to 1906, instructor and head of department in the Baltimore City College. In 1906, he was appointed Principal of the Western High School, and he has held that position since that time.

